safety/seismic safety Element

A portion of THE SAN JOAQUIN COUNTY GENERAL PLAN

September, 1978

83 01210

ADOPTION OF THE SAFETY/SEISMIC SAFETY ELEMENT

General Plan Amendment No.	Planning Commission Resolution	Planning Commission Date	Board of Supervisors Resolution	Board of Supervisors Date
GP-79-2	PC-79-48	10-23-78	R-78-2063	11-30-78

ELEMENT AMENDMENTS

For current status of the Element, contact the San Joaquin County Planning Department, 1810 E. Hazelton Avenue, Stockton, California 95205 Phone (209) 944-2203

ADDENDUM

TO THE DRAFT SAFETY/SEISMIC SAFETY ELEMENT

In the adoption of the Safety/Seismic Safety Element the following changes were made. Underlining indicates an addition.

P. II-18, line 360: "...recent preliminary office report..."

P. II-18, line 397: "...~~the existing~~ preliminary estimates of subsidence rates..."

P. II-19, Exhibit II-9: "3.0 preliminary estimates of depth..."

P. II-19, Exhibit II-9: "Delta Subsidence, draft preliminary memorandum..."

P. II-20, line 401: "~~It is estimated~~ Preliminary estimates indicate..."

P. II-21, Exhibit II-10: "Anaerobic Decomposition[2]"

P. II-21, Exhibit II-10, Footnote 1: "...Preliminary Memorandum Report (first draft),"

P. II-21, Exhibit II-10, Additional footnote: "[2]Presently under further investigation"

P. III-12 through III-22, Addition to each 100 year flood area map: "Preliminary, Subject to Revision"

P. III-24, Exhibit III-16: "Source: San Joaquin County Planning Department, August, 1978."

P. VI-3 to P. VI-9: Substitute revised pages VI-3 to VI-8

P. B-2, reference 15: "... Preliminary Memorandum Report (first draft),..."

P. B-2, add reference: "28. California Department of Water Resources. Letter from Wayne MacRostie, September 29, 1978.

PREFACE

The San Joaquin County Safety/Seismic Safety Element has updated and expanded the Safety and Seismic Safety Elements of the San Joaquin County Council of Governments. Recent data from the California State Division of Mines and Gelolgy, the California Office of Emergency Services, the U.S. Army Corps of Engineers, and other sources have been incorporated. The scope of investigation has in many cases been expanded and new sections have been included.

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LIST OF EXHIBITS

CHAPTER I

POLICY AND SCOPE

GOAL

It is the goal of San Joaquin County to achieve acceptable levels of protection from natural and man-made hazards to life and property.

OBJECTIVES

1. To identify existing and potential hazards to the public safety;

2. To describe the potential risk;

3. To determine acceptable levels of risk and protection;

4. To minimize the adverse economic, social, and physical impacts from safety hazards and emergency situations;

5. To ensure compatibility among land uses where hazards are involved;

6. To identify problems in the provision of protective and emergency services;

7. To determine an appropriate level of emergency services;

8. To delineate means by which public safety considerations will be incorporated into public and private agency functions.

GENERAL PRINCIPLE

The General Plan shall not designate urban uses in areas subject to the hazards identified in this element, unless acceptable protective measures can be taken.

PURPOSE AND SCOPE OF THE ELEMENT

The purpose of the Safety/Seismic Safety Element of the General Plan is to bring safety considerations into focus in land use planning in order to reduce loss of life, injuries, damage to property and economic and social dislocation. This is accomplished through an analysis of hazards, an evaluation of risk to life and property, and policies for hazard mitigation.

Because the Safety and Seismic Safety Elements are so closely related, they are presented as a single document. The Element considers seismic and geologic occurrances, flood, fire, crime, and other miscellaneous hazards.

The following County plans also deal with potential hazards to the safety of the population:

Open Space/Conservation Element - water and air quality degradation

Land Use/Circulation Element - land use and transportation hazards; multi-hazards in the Delta; sewage treatment; solid waste disposal; police and fire protection; emergency services

Noise Element - noise hazards

Air Quality Maintenance Plan - air quality

The policies of the Safety/Seismic Safety Element are not intended to remove all risks or to remove all hazards. They are designed to reduce risks to life and property from certain hazards, and will, when implemented, provide a greater degree of safety in case of a disaster.

LEGAL FRAMEWORK

California Government Code Section 65302(f) requires a Seismic Safety Element in all city and county general plans:

> "A seismic safety element consisting of an identification and appraisal of seismic hazards such as susceptibility to surface ruptures from faulting, to ground shaking, to ground failures, or to the effects of seismically induced waves such as tsunamis and seiches.
>
> "The seismic safety element shall also include an appraisal of mudslides, landslides and slope stability as necessary geologic hazards that must be considered simultaneously with other hazards such as possible surface ruptures from faulting, ground shaking, ground failure and seismically induced waves."

Government Code Section 65302(i) requires a Safety Element in all city and county general plans:

> "A safety element for the protection of the community from fires and geologic hazards including features necessary for such protection as evacuation routes, peak load water supply requirements, minimum road widths, clearances around structures, and geologic hazard mapping in areas of known geologic hazard."

ASSUMPTIONS

Public safety as discussed in the element and the proposed policies and programs to minimize hazards are based on the following assumptions:

1. It is impossible to eliminate all hazards. For any given hazard some degree of risk might always exist.

2. Cost may limit the amount of protection that is provided.

3. Actions which affect hazards to life will generally have a higher priority than actions which affect hazards to property.

"ACCEPTABLE RISK" - HOW SAFE IS SAFE ENOUGH?

Risk involves both awareness and choice: the voluntary taking of a certain degree of chance. Generally, it falls upon government to take the responsibility to educate the public as to the risks involved in the surrounding environment, to minimize the risk, and to protect the public safety.

A crucial question that hazard reduction programs must answer is "how safe is safe enough?" Since it is impossible or often undesirable to remove all risks in the environment, it is important to define the level of risk at which no action to alleviate that risk is deemed necessary. Acceptable risks are perceivable risks to life and property that are tolerated due to technological limitations, limited resources or conflicting priorities. Unacceptable risks are perceivable risks that must be reduced through ongoing action programs.

People or communities faced with different hazards define where the line between acceptable and unacceptable risks lies and make decisions to reduce a hazard based on a)their perception of the hazard, b)the range of choices open to them, and c)the economic viability and efficiency of the alternatives. Then, through various programs, they reduce the hazard to an acceptable level, or increase the acceptable level to include the hazard.

CHAPTER II

GEOLOGIC HAZARDS

PRINCIPLES

1. Soils engineering and geologic studies should be required in the design of new key emergency facilities.

2. Design and construction methods shall minimize impacts of liquefaction and subsidence.

3. In order to evaluate land stability under both static and seismic conditions, geologic and soils investigations should be required prior to approval of major commercial or industrial development, mobilehome parks, or subdivisions in areas subject to landslides.

4. Facilities to be used in emergency responses should be able to remain operational following a maximum credible earthquake. These facilities include communication equipment centers, police and fire stations, emergency shelters, medical facilities, utilities, and major transportation routes.

5. Facilities whose failure could cause large numbers of injuries or deaths should be capable of withstanding a maximum credible earthquake.

6. Because of multiple hazards in the Delta, urban development shall not be permitted outside of existing urban centers.

7. Programs to conserve the Delta peat soils should be encouraged.

8. Proposals for new dams should consider the seismic hazard, and no dams should be built if there is a probable hazard to San Joaquin County.

IMPLEMENTATION ACTIONS

1. The preparation of Community Plans should include an inventory of structures which are likely to fail or pose a hazard in an earthquake. A program for abatement of the hazards should be prepared, and it should include identification of specific measures for preservation of architecturally or historically significant structures. (Planning, Building)

2. Methods to reinforce hazardous architectural ornaments, particularly parapets, cornices, and marquees, should be compiled and made available to owners of structures with hazards. (Planning, Building)

3. The County should encourage and participate in State and Federal studies on levee stability and improvement. (Public Works, Planning, Reclamation Districts)

4. The County should ensure that the Delta Levee Investigation, being conducted by the Federal and State governments, includes analysis of levee failure by liquefaction. (Planning, Reclamation Districts)

5. The County should support further study of the San Joaquin Fault Zone and should modify the Safety Element, as necessary, when the probable hazard of this fault system is known.

SEISMIC HAZARDS[1]

SEISMICITY

Seismic activity is caused by release of energy that has been stored within the earth. It is believed that this energy is generated by forces that are causing the earth's continents to move apart. This theory, called "Plate Tectonics", holds that the earth is made up of several large plates that are moving past each other. As the plates move past one another, stress builds and many adjustments take place in the earth's crust. Since the earth's bedrock formations are somewhat elastic, they may, under pressure from plate movements, bend and become permanently distorted, forming mountains and valleys or store energy to be released later.

When the stress is great enough, the earth's crust breaks or slips along an old crack (fault) or forms a new one. Areas where a number of parallel slippages occur are called fault zones. When an earthquake occurs, the break along the fault begins in a small area and rapidly moves up and down the fault. The location of the first release of energy is called the focus. The point on the earth's surface directly above the focus is called the epicenter.

Releases of energy may occur in a few large amounts, or in more numerous, smaller amounts. A more or less constant release of energy (creeping) can also occur. During an earthquake, opposite sides of a fault-move in relation to each other. Movement might occur at great depths and be hidden within the earth or may extend to the earth's surface and form a surface break (trace).

The stress release of an earthquake is expressed in several ways on the earth's surface. The most common expression is groundshaking, the result of wave movement through the rock materials of earth's crust. This ground motion is not constant.

The type, configuration, depth, and density of underlying soil and rock, together with distance, determine the direction and speed of groundshaking. As ground waves pass from rock to less dense materials, (e.g., alluvial or water-saturated soils), they reduce speed and generally increase in the extent of vibration, resulting in shaking for a longer period of time with larger, slower vibrations. Therefore, distance from an earthquake alone does not necessarily determine the intensity and duration of groundshaking that will occur. Surface topography also can amplify earthquake waves.

MEASURES OF SEISMIC ACTIVITY

Earthquakes are measured in two different ways: 1)by their physical effects and 2)by the amount of energy being released. The scale used to measure intensity (physical effects) of an earthquake is the Modified Mercalli Scale, and the scale used to measure the magnitude of earthquakes (energy released) is the Richter Scale.

The intensity of the physical effects of earthquakes are based on human reactions at the low end of the Modified Mercalli Scale (e.g., "felt indoors

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[1]This section is excerpted from the COG Seismic Safety Element(1).

Exhibit II-1
MODIFIED MERCALLI SCALE

THE MERCALLI INTENSITY SCALE
(As modified by Charles F. Richter in 1956 and rearranged)

If most of these effects are observed	*then the intensity is:*
Earthquake shaking not felt But people may observe marginal effects of large distance earthquakes without identifying these effects as earthquake-caused. Among them trees, structures, liquids, bodies of water sway slowly, or doors swing slowly.	*I*
Effect on people: Shaking felt by those at rest, especially if they are indoors, and by those on upper floors.	*II*
Effect on people: Felt by most people indoors. Some can estimate duration of shaking. But many may not recognize shaking of building as caused by an earthquake; the shaking is like that caused by the passing of light trucks.	*III*
Other effects: Hanging objects swing. *Structural effects:* Windows or doors rattle. Wooden walls and frames creak.	*IV*
Effect on people. Felt by everyone indoors. Many estimate duration of shaking. But they still may not recognize it as caused by an earthquake. The shaking is like that caused by the passing of heavy trucks, though sometimes, instead, people may feel the sensation of a jolt, as if a heavy ball had struck the walls. *Other effects:* Hanging objects swing. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. *Structural effects:* Doors close, open or swing. Windows rattle.	*V*
Effect on people: Felt by everyone indoors and by most people outdoors. Many now estimate not only the duration of shaking but also its direction and have no doubt as to its cause. Sleepers wakened. *Other effects:* Hanging objects swing. Shutters or pictures move. Pendulum clocks stop, start or change rate. Standing autos rock. Crockery clashes, dishes rattle or glasses clink. Liquids disturbed, some spilled. Small unstable objects displaced or upset. *Structural effects:* Weak plaster and Masonry D* crack. Windows break. Doors close, open or swing.	*VI*
Effect on people: Felt by everyone. Many are frightened and run outdoors. People walk unsteadily *Other effects:* Small church or school bells ring Pictures thrown off walls, knicknacks and books off shelves. Dishes or glasses broken Furniture moved or overturned Trees, bushes shaken visibly, or heard to rustle *Structural effects.* Masonry D* damaged; some cracks in Masonry C*. Weak chimneys break at roof line Plaster, loose bricks, stones, tiles, cornices, unbraced parapets and architectural ornaments fall. Concrete irrigation ditches damaged.	*VII*
Effect on people. Difficult to stand. Shaking noticed by auto drivers *Other effects:* Waves on ponds; water turbid with mud. Small slides and caving in along sand or gravel banks. Large bells ring. Furniture broken. Hanging objects quiver. *Structural effects:* Masonry D* heavily damaged; Masonry C* damaged, partially collapses in some cases; some damage to Masonry B*; none to Masonry A*. Stucco and some masonry walls fall. Chimneys, factory stacks, monuments, towers, elevated tanks twist or fall. Frame houses moved on foundations if not bolted down; loose panel walls thrown out. Decayed piling broken off.	*VIII*
Effect on people: General fright. People thrown to ground. *Other effects:* Changes in flow or temperature of springs and wells. Cracks in wet ground and on steep slopes. Steering of autos affected. Branches broken from trees. *Structural effects:* Masonry D* destroyed; Masonry C* heavily damaged, sometimes with complete collapse; Masonry B* is seriously damaged. General damage to foundations. Frame structures, if not bolted, shifted off foundations. Frames racked. Reservoirs seriously damaged. Underground pipes broken.	*IX*
Effect on people: General Panic. *Other effects:* Conspicuous cracks in ground. In areas of soft ground, sand is ejected through holes and piles up into a small crater, and, in muddy areas, water fountains are formed. *Structural effects:* Most masonry and frame structures destroyed along with their foundations. Some well-built wooden structures and bridges destroyed. Serious damage to dams, dikes and embankments. Railroads bent slightly.	*X*
Effect on people: General panic. *Other effects:* Large landslides. Water thrown on banks of canals, rivers, lakes, etc. Sand and mud shifted horizontally on beaches and flat land. *Structural effects:* General destruction of buildings. Underground pipelines completely out of service. Railroads bent greatly.	*XI*
Effect on people: General panic. *Other effects:* Same as for Intensity X. *Structural effects:* Damage nearly total, the ultimate catastrophe. *Other effects:* Large rock masses displaced. Lines of sight and level distorted. Objects thrown into air.	*XII*

* Masonry A Good workmanship and mortar, reinforced, designed to resist lateral forces.
Masonry B. Good workmanship and mortar, reinforced
Masonry C. Good workmanship and mortar, unreinforced.
Masonry D. Poor workmanship and mortar and weak materials, like adobe

SOURCE: Urban Geology Master Plan, 1973

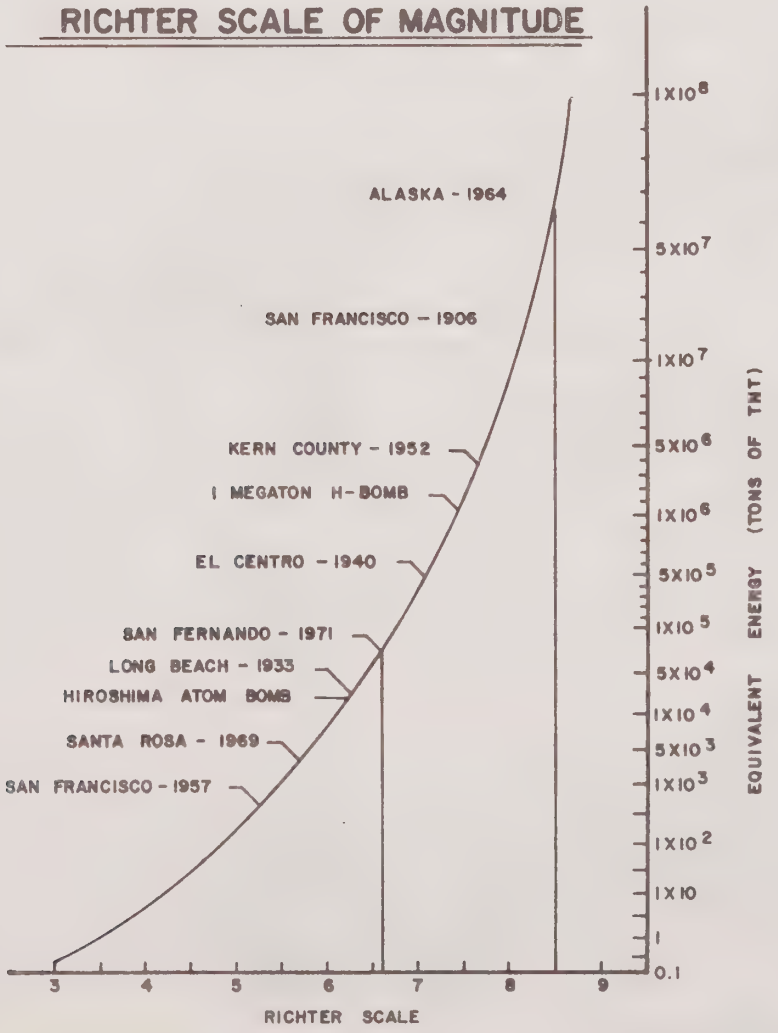
by a few") and by geologic effects at the high end of the Scale (e.g., "numerous and extensive landslides"). The middle range is based largely on the degree of damage to man-made structures. Ratings are based on human observations and are not measured with instruments. The intensity of an earthquake varies from place to place because of geologic conditions, distance from the earthquake epicenter, and type of building structures. Exhibit II-1 describes the twelve levels of intensity.

In 1932, Charles Richter devised a method of measuring the magnitude of an earthquake using seismic instruments. The magnitude is a number assigned to the calculated energy release of an earthquake. This system can be used to rank and compare the energy release of various earthquakes.

The Richter Scale is logarithmic. An increase of one number in magnitude is the same as a 32 times increase in energy. Thus a magnitude 7 earthquake releases 32 times more energy than a magnitude 6 earthquake. Exhibit II-2 compares different events on the Richter Scale.

Exhibit II-2

RICHTER SCALE OF MAGNITUDE



EARTHQUAKE FAULTS

Faults are indications of past seismic activity. It is assumed that those that have been active recently are the most likely to be active in the future, although even an inactive fault may not be "dead." The recency of activity is measured in geologic terms, or geologic time. Geologically recent is within the past two million years (the Quaternary period). All faults believed to have been active during Quaternary time are considered "potentially active" by the State Division of Mines and Geology. Those which have exhibited activity within the last 11,000 years are called "active." If a fault is considered to be "historically active", it has exhibited activity within the last 200 years. Faults for which there is no evidence of activity during the last two million years are considered to be inactive(7).

FAULTS IN AND NEAR SAN JOAQUIN COUNTY

Exhibits II-3 and II-4 illustrate faults located within or near the County. Seismic activity on these faults or in these fault zones has the greatest potential for causing damage in the County. Some of the faults are active and some inactive, as discussed below. Seismic activity in other parts of the State can also affect the County, but its potential impact is not as great. Exhibit II-7 identifies the maximum credible or probable earthquake intensities which have a probability of occurring in San Joaquin County.

1. San Andreas Fault Zone

The San Andreas Fault is one of the longest, most thoroughly studied, and most active faults in the world. Some sections in the Central Coast Ranges south of San Joaquin County are creeping at rates as great as 3.5 centimeters per year. Other segments, north and south of the creep areas, exhibit essentially no movement. The fault in those areas appears to be temporarily "locked." It is generally agreed that a "locked" condition allows stresses to accumulate more rapidly, thus shortening the time between major earthquakes.

It is possible to demonstrate an accumulated offset along the San Andreas Fault measured in hundreds of miles, occurring over a period of tens of millions of years. Since there is presently movement along some of its length, and numerous smaller earthquakes are recorded as emanating from the fault zone, it is practically a certainty that moderate to great earthquakes will occur on the San Andreas fault in the foreseeable future. The maximum probable intensity which could occur in San Joaquin County would be VIII or IX--large enough to cause fright and serious damage.

2. Hayward Fault

The Hayward Fault is located east of San Francisco Bay and extends southeast to where it probably merges with the Calaveras Fault north of Hollister. A review of the recent history of this fault shows two major earthquakes (1836 and 1868), each with an estimated Richter Scale Magnitude of 6.5-7.5. Current measurements indicate creeping at rates up to 1 centimeter per year in places. Numerous small earthquakes (Richter Scale Magnitude of 3 to 5) have occurred along this fault in recent years, indicating continued activity.

3. Calaveras Fault

The Calaveras Fault borders the eastern flank of the Berkeley-Hayward Hills, extends to the southeast where it joins the San Andreas Fault south of

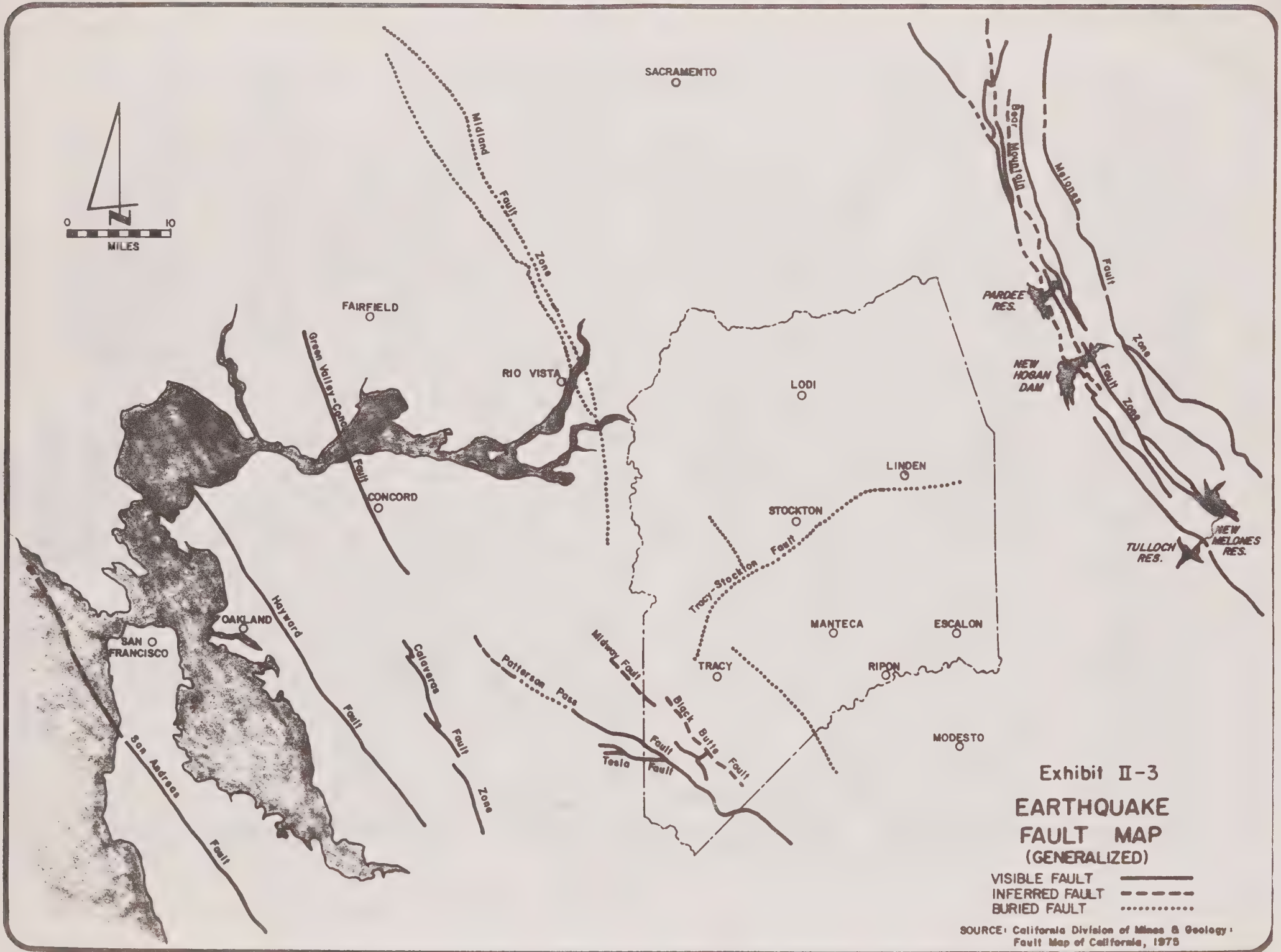


Exhibit II-3

EARTHQUAKE FAULT MAP (GENERALIZED)

VISIBLE FAULT ———

INFERRED FAULT – – – –

BURIED FAULT .....

SOURCE: California Division of Mines & Geology: Fault Map of California, 1975

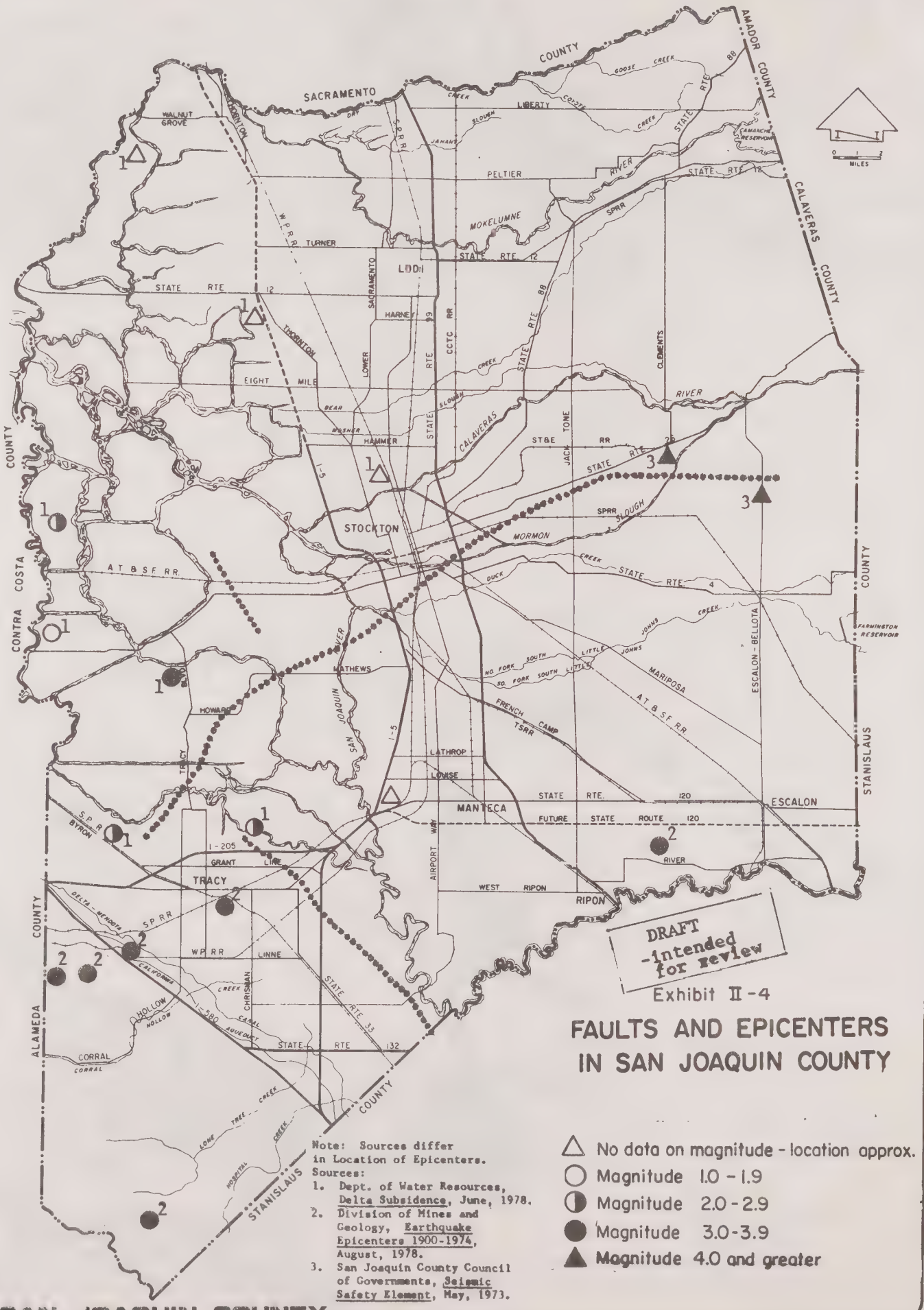


Exhibit II-4

FAULTS AND EPICENTERS IN SAN JOAQUIN COUNTY

Note: Sources differ in Location of Epicenters.
Sources:

1. Dept. of Water Resources, Delta Subsidence, June, 1978.
2. Division of Mines and Geology, Earthquake Epicenters 1900-1974, August, 1978.
3. San Joaquin County Council of Governments, Seismic Safety Element, May, 1973.

△ No data on magnitude - location approx.
○ Magnitude 1.0 - 1.9
◑ Magnitude 2.0 - 2.9
● Magnitude 3.0-3.9
▲ Magnitude 4.0 and greater

Hollister. Epicenters of recent earthquakes with Richter Magnitude up to about 4.5 have been located along, or near, this fault. In 1868 an earthquake of unknown magnitude caused ground breakage near Danville. Several centimeters of creep have been measured in Hollister, where a Calaveras Fault trace cuts through a residental area. The pattern of offset curbs and sidewalks is similar to that of creep and faulting along other branches of the San Andreas system.

4. Green Valley-Concord Faults

This fault zone, extending from Walnut Creek to west of Fairfield, has experienced displacement throughout most of its length within recent geologic time. An earthquake of 5.4 magnitude occurred in 1955 along part of the fault near Concord. There is currently evidence of some movement along the fault in the City of Concord. The greatest probable earthquake generated by this fault is not expected to exceed a magnitude of 7.0 on the Richter Scale.

5. Midland Fault

The Midland Fault, buried under recent alluvium, extends north from Bethel Island in the San Joaquin Delta, to east of Lake Berryessa. Its activity is not as well documented as the previously discussed faults. However, there is evidence that fault displacement has occurred during recent geologic time. Also, the State Division of Mines and Geology believes that the Midland Fault is a possible source of a major earthquake centered near Vacaville in 1892. The maximum probable earthquake which would be generated by this fault is a magnitude of 7.0 on the Richter Scale.

6. San Joaquin Fault Zone

A new fault system has recently been identified by the U.S. Geologic Survey(25). The San Joaquin Fault Zone extends from Tracy to Los Banos, paralleling Interstate 5. Geologic studies show that the zone has sustained activity during the Quaternary period. This could be a very important fault system for San Joaquin County. It should be precisely mapped by next year and further study of it can be expected.

7. Tracy-Stockton Fault

The Tracy-Stockton Fault crosses the County from the southwest near Tracy to the northeast near Linden. It passes directly beneath Stockton. Its position is known only from oil well log data, since no surface trace of this fault has been mapped. Subsurface data indicate that no appreciable movement has occurred on the Tracy-Stockton Fault for five million years or more. Ordinarily, such evidence would lead to the conclusion that the fault is inactive and therefore, does not pose an earthquake threat. There is, however, evidence of activity near the easternmost subsurface positions of the fault. On April 10, 1881, an earthquake occurred near Linden having an estimated Modified Mercalli Intensity of VII. Although direct correlations between intensity and magnitude are not precise, this earthquake was approximately Richter Magnitude 5. Two other smaller earthquakes (Richter Magnitude 4) occurred on September 19 and 20, 1940, approximately five miles south of Linden. The latter epicenter was instrumentally located, but only in a "rough" manner. It is therefore not certain whether or not these epicenters lie along a northeast extension of the Tracy-Stockton Fault. There is, however, the possibility of an active fault capable of at least a 5.0 Magnitude earthquake located in or near the central part of San Joaquin County.

8. Patterson Pass Fault

The Patterson Pass Fault runs northwest from the Alameda-San Joaquin County boundary toward Livermore. Its location is imprecise and the nature of movement, if any, is uncertain. The fault is cited here because of one well-located epicenter generating a 4.5 Magnitude earthquake in 1946. It seems unlikely that this small fault presents a significant seismic threat to San Joaquin County in comparison with other fault systems.

9. Small Buried Fault

Two small buried faults have been located by aerial photo analysis in the western portion of the County. The northern one is located on Roberts Island, and the more southern fault extends from near Banta to the County line. The latter appears to be buried beneath young sediments(1). Associated land forms suggest geologically recent activity, although this fault has not been historically active. Additional field investigation of this fault is warranted.

10. Melones-Bear Mountain Fault Zones

The Melones and Bear Mountain Fault Zones extend in a wide band along the western edge of the Sierra Nevada Mountains in the higher elevation foothills. Beginning near the southwest corner of Yosemite National Park, the fault zones run through Mother Lode communities ending in the foothills east of Red Bluff.

The Melones and Bear Mountain Fault Zones have exhibited little seismic activity and have been considered to be inactive, since no evidence have been found of Quaternary fault movement. The U.S. Geological Survey has been monitoring activity along the two fault zones in the vicinity of New Melones Dam since 1972 and have found a lack of even micro-seismic activity(3).

Because of the location of Tulloch, New Melones, New Hogan, Jackson Creek and Pine Flat Reservoirs within the Melones and Bear Mountain Fault Zones, the question of the activity of these faults is extremely serious for San Joaquin County. Failure of a dam at any one of the reservoirs could cause flooding in the County. (See Chapter III.)

On August 1, 1975, a 5.7 Magnitude earthquake took place near Oroville. The Oroville earthquake is important because it took place in an area where a quake of such magnitude was not expected and because it occurred in the Sierra Nevada foothills. "Many geologists and seismologists feel that this earthquake is a fair warning that earthquakes of magnitude 6 can occur anywhere in California and at any time..."[1]

James E. Slosson, formerly State Geologist, now a State Seismic Safety Commissioner, concluded that "the Oroville earthquake should be interpreted as related to the tectonics or crustal strain pattern for this region.... The Oroville earthquake suggests that this event is indicative of future earthquakes within the fault zones of the western Sierra Nevada foothills. If this hypothesis is reasonable, earthquakes of at least magnitude 6 should be anticipated...." The report goes on to state: "the fault zones of the western

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[1]California State Division of Mines and Geology; Oroville, California Earthquake 1, August 1975, Special Report 124, 1975.

Sierra Nevada foothills extending from Bakersfield to Chico should be re-analyzed with consideration given to the 1940 and 1975 earthquakes in Butte County, the alignments of faults associated with topographic features of terrain and current "state-of-the-art" in both seismology and geology."[1] Since upstream dam failure could lead to massive flooding in San Joaquin County, it is extremely important to the County that the Melones and Bear Mountain Fault Zones be reanalyzed.

11. Tesla and Black Butte Faults

Neither of these faults, located in the southwest corner of San Joaquin County have any recorded evidence of activity.

12. Other Faults

Earthquakes along faults in the Owens Valley, Kern County (White Wolf Fault), near Oroville, and in Nevada have been felt in San Joaquin County. However, because of the distance of these faults they do not pose a significant seismic hazard to the County.

EARTHQUAKE HISTORY IN THE COUNTY

Within the last 150 years the San Joaquin County area has experienced several earthquakes of intensity V or greater on the Modified Mercalli Scale. The following table lists these quakes:

EXHIBIT II-5

EARTHQUAKES IN SAN JOAQUIN COUNTY
(OF INTENSITY V OR GREATER)

Date	MM Intensity in SJ County	MM Intensity near Epicenter	Epicenter	Richter Magnitude at Epicenter
1836	V-VI	IX-X	Hayward	7+
1838	VI	X	S.F. Peninsula	7+
1857	VI	X-XI	Mountains between Santa Barbara & Bakersfield	8+
1868	V-VI	IX-X	Hayward	7+
1872	VI	X	Owens Valley	8+
1881	V-VI (?)	VII	Linden	5+
1892	IV-V	VIII	Vacaville	approx. 7
1906	VI-VII	XI	San Francisco	8.3
1940	?	?	Southeast of Linden	4.0
1946	?	?	Patterson Pass	4.5
1952	V	VIII	Bakersfield	approx 7.7
1966	IV-V	VII	North of Tahoe	approx 6.5

The isoseismal map on the following page shows lines of equal earthquake intensity plotted for three of the above earthquakes.

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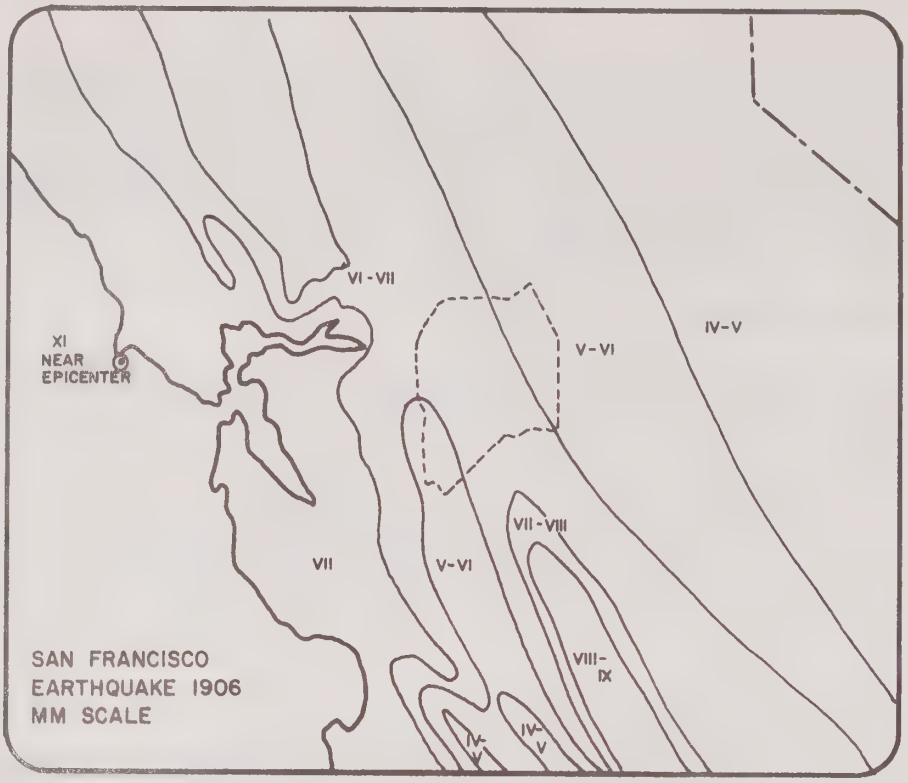
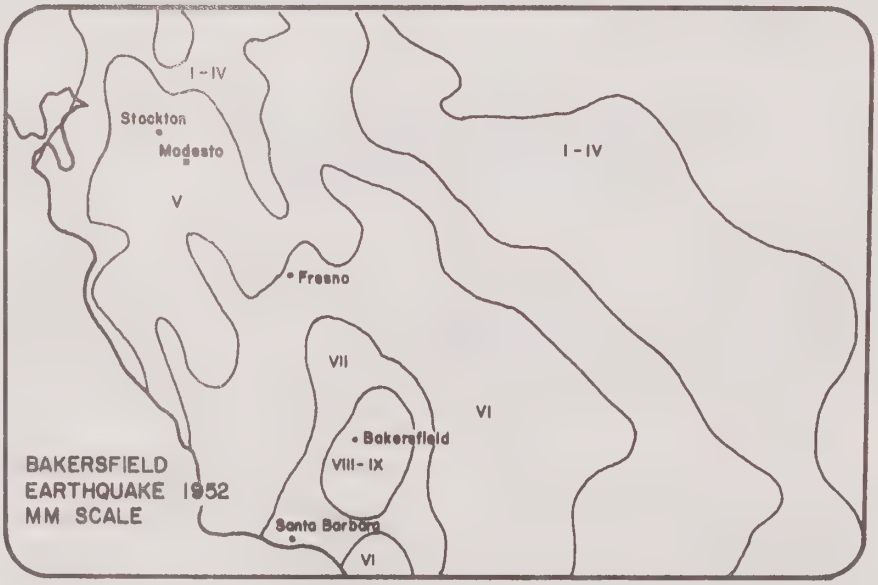
[1] California State Division of Mines and Geology; Oroville, California, Earthquake 1, August 1975, Special Report 124, 1975.





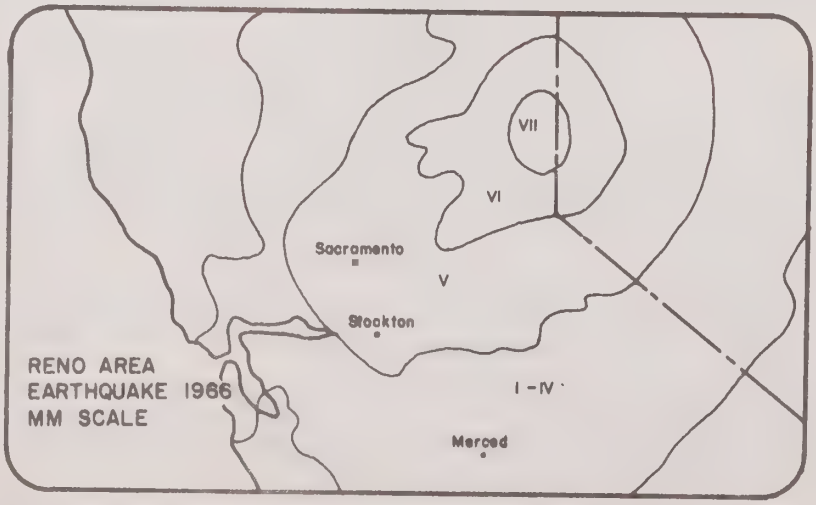


Exhibit II-6

ISOSEISMAL MAPS

EXHIBIT II-7

SEISMIC TABLE REFERENCED TO STOCKTON

Source of Earthquake	Closest Distance (miles to Causative Fault	Maximum Credible Earthquake Magnitude occurring at Epicenter	Predominant Period of Rock* Acceleration (Ground surface Acceleration will differ depending upon subsurface ground conditions)	Duration of strong shaking	Estimated Recurrence of Maximum Credible Event	Fault Activity Rating	Maximum Credible Earthquake Intensity which could occur in Stockton (MM Scale)
Calaveras Fault	40	7.5	.13	37 seconds	Unknown	1,2,3	VIII or IX
Midland F.	19	7.0	.13	30 sec.	Unknown	5	VIII or IX
Tracy-Stockton F.	in City	5+	.11	30 sec.	Unknown	6	IX
Hayward F.	48	7.5	.11	24 sec.	Unknown	1,2,3	VIII or IX
San Andreas	66	8.3	.11	24 sec.	102 years	1	VIII or IX
Green Valley	41	7.0	.07	less than 18	Unknown	4	VIII or IX

*Rock: Any material with a shear wave greater than 2000 feet/second

Fault Activity Ratings:

1-4: Strong evidence of a relatively high degree of activity. 1: Surface rupture during a historic earthquake; 2: Presently occurring creep; 3: Alignment of earthquake epicenters; 4: Recent Geologic surface displacement but no historic records

5: Possible source of a major historic earthquake

6: Possible source of small historic earthquakes

Sources: Greensfelder, Roger, "Maximum Credible Rock Acceleration from Earthquake in California" Division of Mines and Geology, Sacramento, 1974, and Wallace, R.E. Geological Society of America Bulletin Volume 81, Page 2875, 1970.

Derived from COG Seismic Safety Element (1).

FUTURE SEISMICITY IN SAN JOAQUIN COUNTY (2)

Initial Effect: Groundshaking

Strong groundshaking poses a greater seismic threat than the possibility of a local ground rupture. The most likely sources of strong groundshaking are the San Andreas, Hayward, Calaveras, Midland, Green Valley-Concord, and Tracy-Stockton Faults. The intensity of groundshaking from earthquakes on these and other faults is dependent on the earthquake's magnitude, distance, and soil and rock properties. With these factors in mind, it is not unreasonable to expect groundshaking equivalent to an intensity of VIII or IX on the Modified Mercalli Scale. Insufficient data exists on the dynamic properties of subsurface soils in San Joaquin County to precisely define the characteristics of the "maximum probable" earthquake at ground surface. However, some general observations can be made:

a. The depth of soil overlying "rock-like" material varies within the County from depths of less than 100 feet up to 1000-2000 ft.

b. In general, deep deposits of soft soils tend to produce ground motions which have a greater effect on tall structures and lesser effects on short rigid structures.

c. Shallow deposits of stiff soil tend to produce ground motions having maximum effects on low rigid structures and lesser effects on tall buildings.

d. Therefore, the ground motion expected in Stockton, Tracy, and much of San Joaquin County where soil depths are greatest would tend to have its greatest effect on taller structures (over 3-4 stories high). Ground motions which would have greater effects on low structures would be more likely in the foothills of the southwest and eastern areas of the County.

Since ground surface faulting or displacement of the Tracy-Stockton Fault or others in the County is considered unlikely, the need for set-back requirements of structures along the bases of the faults is not foreseen.

Secondary Effects

In addition to local ground rupture and general groundshaking, an earthquake can trigger many other actions. These secondary effects can cause as much, or more, damage as the earthquake itself. Secondary effects may include: liquefaction, tsunamis, seiches, landslides, subsidence, floods, and a possible cumulative effect of crippling emergency responses. Since landslides and subsidence are hazards even without seismic activity, these are discussed under Other Geologic Hazards on page II-17.

Liquefaction(2)

Liquefaction is a soil phenomenon in which a water-saturated cohesionless soil temporarily loses its strength and liquefies when subjected to dynamic forces such as intense and prolonged groundshaking. If the liquefying layer is a few feet below the surface, it may provide a sliding surface for the ground above it, causing landsliding.

A great deal of damage in recent earthquakes (Chile, 1959; Alaska, 1964; Nigata, Japan, 1964; and San Fernando, 1971) has been caused by soil liquefaction. When liquefaction occurs, building foundations may sink or tilt into

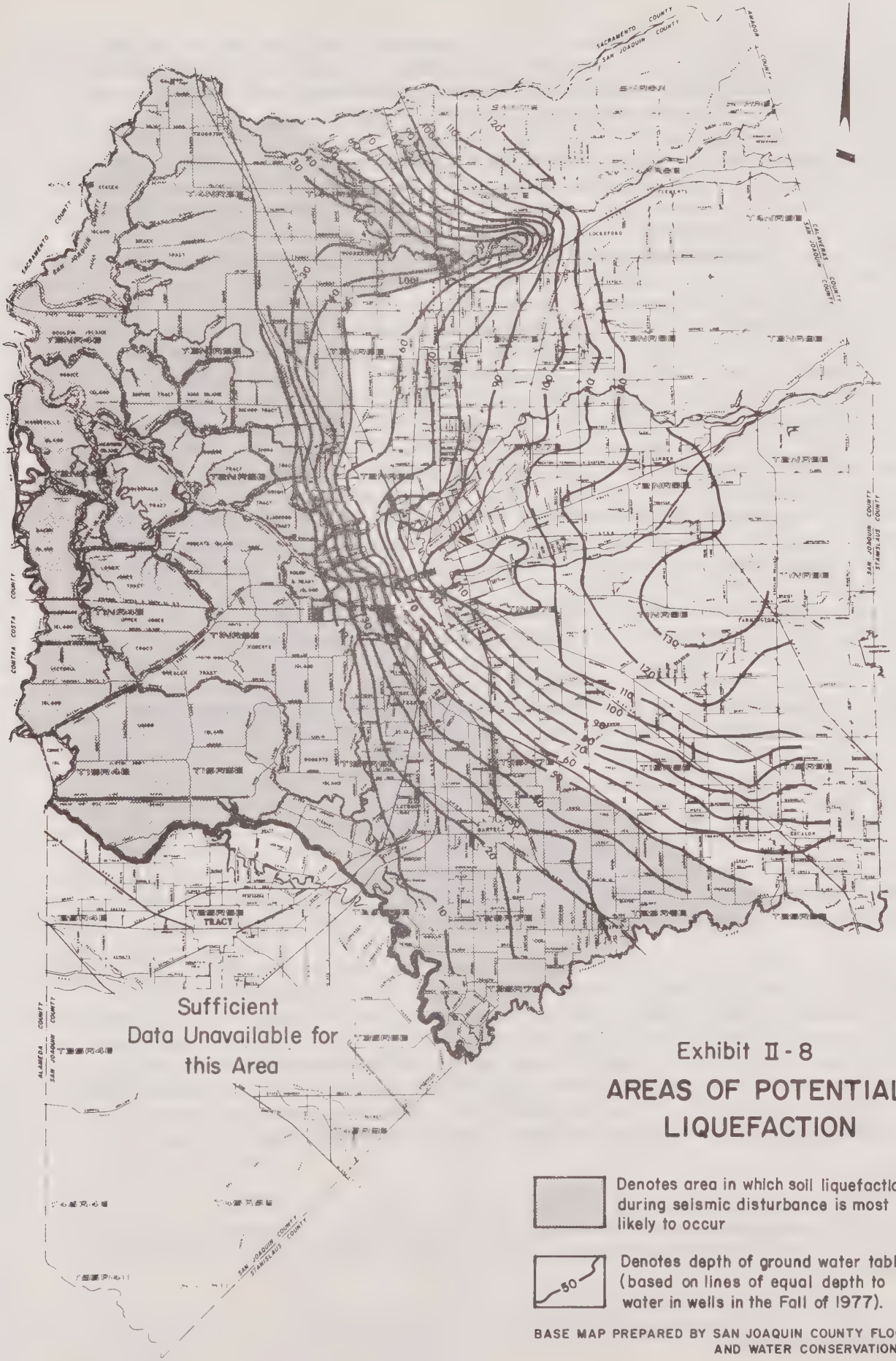


Exhibit II-8

AREAS OF POTENTIAL LIQUEFACTION

Denotes area in which soil liquefaction during seismic disturbance is most likely to occur

Denotes depth of ground water table (based on lines of equal depth to water in wells in the Fall of 1977).

BASE MAP PREPARED BY SAN JOAQUIN COUNTY FLOOD CONTROL AND WATER CONSERVATION DISTRICT

SAN JOAQUIN COUNTY PLANNING DEPARTMENT AUGUST 1978

the underlying soil, differential ground subsidence may occur, or landsliding may take place. In the San Fernando earthquake a landslide causing extensive damage was attributed to soil liquefaction. The movement-occurred on an average ground slope of two degrees.

The areas which are believed to have the greatest potential for liquefaction are those areas in which the water table is less than 50 feet below ground and the soils are predominantly clean, relatively uniform sands of loose to medium density. Clay-type soils are generally not subject to liquefaction. The closer the ground water is to the surface, the greater is the potential for liquefaction.

The areas of San Joaquin County considered most susceptible to liquefaction include the Manteca-Lathrop area, the area just west of Woodbridge (including a small portion of the townsite), and the Delta. The soils in the Tracy area are not considered to be as susceptible to liquefaction, even though the groundwater table is high, because the near-surface soils are predominantly clays or sands with high silt and clay content. The east and northeast portions of the County are less susceptible because groundwater is deeper.

The primary danger of liquefaction in the Delta would be the possible failure of the levees. Since there are few major structures in the Delta, damage from building foundation failures would be less prevalent. Since many of the Delta levees are directly underlain by relatively clean, water-saturated sands and peats, strong groundshaking could cause liquefaction under these levees and lead to levee failure and flooding. (See Chapter III: Flood Hazards.)

Whether or not soil will actually liquefy depends on the amplitude and frequency of the wave motion of the groundshaking and its duration. The looser the soil the shorter the duration and the less intensity the shaking needed to cause liquefaction. More dense soils will withstand longer durations of shaking and more intense shaking before liquefaction takes place. The type of earthquake motion expected for San Joaquin County from large earthquakes is expected to be a long rolling type motion, which would be less likely to cause liquefaction. However, if an earthquake were to occur along the Tracy-Stockton Fault, the motion near the fault would tend to be sharp, high frequency vibrations, a type more likely to cause liquefaction.

Although there are several areas of San Joaquin County which have a potential for soil liquefaction during strong groundshaking, the probability of soil liquefaction actually taking place in the County is considered to be relatively small because of the distance from the San Andreas, Hayward and Calaveras Fault Zones, the type of groundshaking expected from those faults, and the relative inactivity of the Tracy-Stockton Fault. However, the possibility of soil liquefaction still exists and should be considered when planning and designing levees and structures in areas of potential liquefaction.

Tsunamis(2)

Tsunamis, seismic sea waves, pose a negligible hazard to San Joaquin County. Tsunamis originating in the Pacific Ocean would be dissipated in San Francisco Bay.

Seiches(2)

Seiches are periodic oscillations of water level in basins. They are primarily a result of seismic sea waves, wind and weather changes, seismically induced ground waves, landslides and tectonic tilting. The period of seiche ranges from a few minutes to a few hours, depending upon the size and shape of the basin of water. The amplitude of a typical seiche ranges from a few inches to several feet.

Seiches occur not only in confined basins, but also in harbors, bays, channels, rivers or other bodies of water. A related effect is the oscillations that can occur in water tanks during earthquakes. Bulges in steel tanks due to earthquake-induced water forces were noted in both the San Fernando earthquake of 1971 and the Nicaragua earthquake of 1972.

A related phenomenon, known as a surge, similar to a seiche but having a larger amplitude and generally greater violence, can also occur. A surge occurred during the 1959 Montana earthquake when the basin of Hebgen Lake subsided differentially and the lake bed was abruptly warped. Surges of water as much as ten feet above normal water level occurred. Oscillation continued for at least 12 hours after the earthquake. The spillway of Hebgen Dam was badly damaged, both by the earthquake and the subsequent surges. Surges or seiches can also occur due to seismically or non-seismically induced landslides.

There are no historical records of a seiche occurring in or adjacent to San Joaquin County. That does not, however, rule out the possibility of one occurring in the future. Seismically induced waves occurring in Delta channels could damage levees. The consequences of the occurrence of seiches or surges should be considered in the design of dams, levees, watertanks or similar structures. In addition, the potential for landsliding into reservoirs must be evaluated.

OTHER GEOLOGIC HAZARDS IN THE COUNTY

In addition to those geologic hazards which are specifically associated with seismic activity, San Joaquin County has the following potential geologic hazards: subsidence, slope instability, expansive soils, and soil erosion.

Subsidence

Subsidence is a general lowering of the ground surface over a large area. In San Joaquin County, subsidence outside the Delta is generally attributed to overdraft of the ground water basin(26). With sustained overdraft the subsurface has compacted and sunk to fill in the void left by the withdrawn and unreplenished ground water. This problem is most prevalent near Stockton, and it should decrease with the city's use of surface water supplies from the new treatment plant.

Subsidence in the Delta is more complex and poses more serious problems. It could ultimately lead to loss of the entire area to agricultural operations, the flooding of the islands, and the formation of a large inland sea.

The islands are composed of peat and other organic soils, with varying amounts of mineral soils. The organic soils make the Delta a valuable farming area, but the soils are highly susceptible to subsidence and the rate of subsidence can be affected by farming practices.

Subsidence is an ongoing process, occurring since the islands were formed and continuing at various rates, with an average estimated rate of 2.8 to 3.0 inches per year (15) (Exhibit II-9). The majority of the islands are below sea level and the increasing subsidence puts additional hydrostatic pressure on the levees, which are themselves unstable. Some portions of the islands in the County are more than 20 feet below sea level. (See Exhibit III-5 & 10 in Chapter III, Flood Hazards.)

Delta subsidence is caused by a variety of factors, as analyzed in a recent report by the State Department of Water Resources (15) and summarized in Exhibit II-10. The major causes, in order of decreasing significance, are oxidation, anaerobic decomposition, shrinkage, and wind erosion.

Oxidation occurs naturally in peat soils. The rate of oxidation increases with increased exposure of the soil surfaces to oxygen. This can occur with repeated tilling and with "dewatering" of the soil by lowering of the water table.

The rate of anaerobic decomposition is also affected by agricultural practices. Successive wetting and drying of the soils will speed it up. This type of decomposition is also accelerated by a high soil pH.

Peat soils hold a great amount of water; the average water content of sample peat has been measured at 545% by weight (15). In farming operations in the Delta, the water table may be lowered to compensate for loss of soil by subsidence. As the water table is lowered, the peat soils dry, and as they dry, they shrink. Their loss of volume results in further subsidence or lowering of the land elevation. Once this shrinkage has occurred, the soil structure is changed and with the loss of porosity, wetting of the soil will not return the peat to its original volume.

Clouds of peat dust can be seen blowing from the Delta on a windy day, particularly in the spring. Occasionally the state roads through the area must be closed because of the poor visibility. It is no surprise, then, that wind erosion of peat contributes to the subsidence problem. This problem has long been recognized(27) and some Delta farmers have begun to change their operations to decrease the erosion.

Other factors which contribute to subsidence have also been identified, but these factors generally have minimal effect or there is little that can be done about them.

If subsidence continues at present rates, the islands will become increasingly subject to flooding (Exhibit II-11). The levees themselves have been constructed of unconsolidated materials, generally dredging from adjacent waterway channels. (See Chapter III, Flood Hazards.) Once the levees fail and the islands flood the public and private expense of repair and reclamation of the island is enormous (22). It is likely that some islands would not be reclaimed and left as permanent "lakes", as was Frank's Tract in 1938.

The actual depletion of organic soils is a possibility. In some areas the thickness of the peat is half what it was when the islands were reclaimed. Basing their calculations on the existing subsidence rates and soil depths, the Department of Water Resources, in a preliminary report, projects that the organic soils on Mandeville Island would be depleted in 70-110 years (15). Exhibit II-12 shows the depth of the organic soils on the islands.

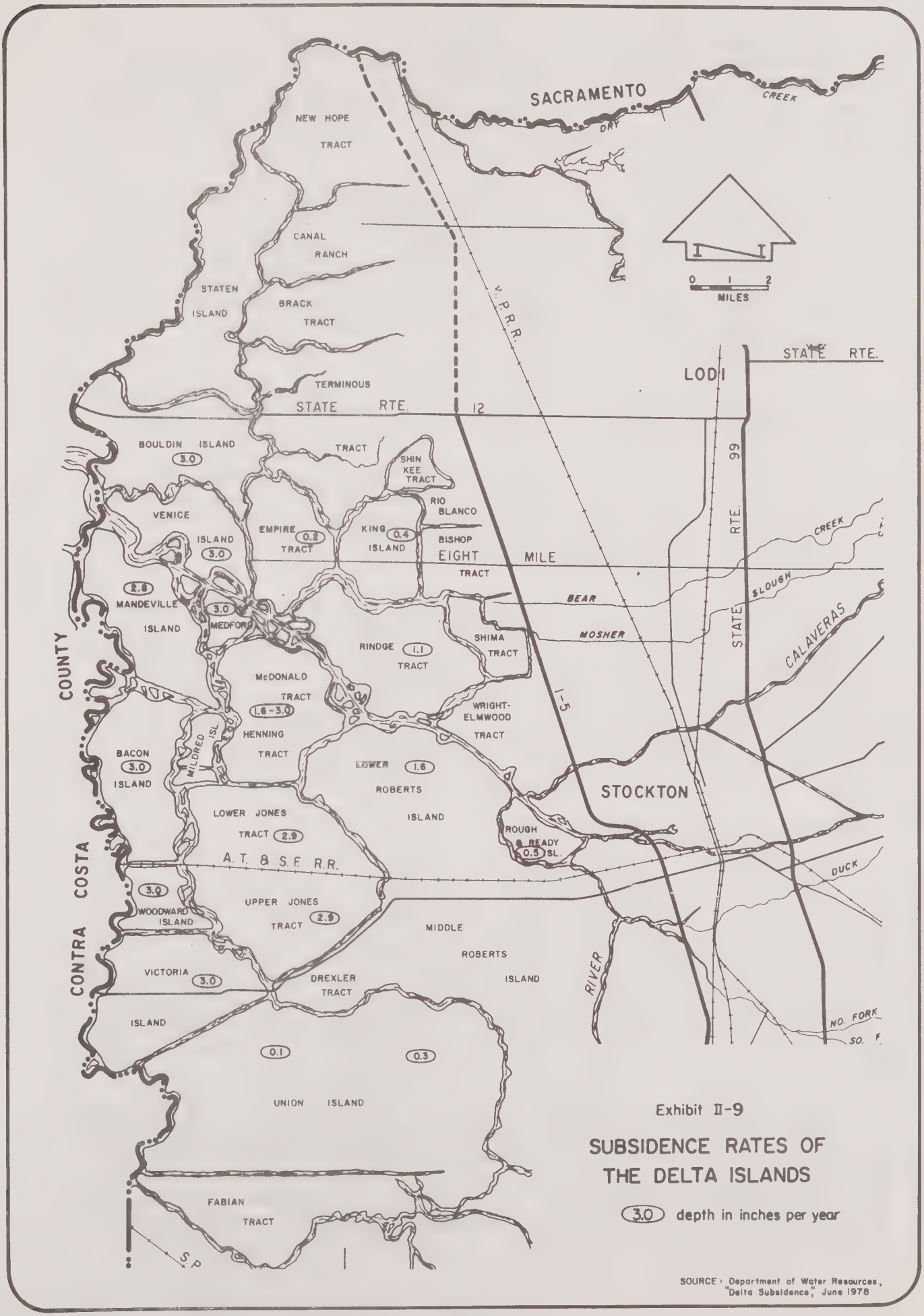


Exhibit II-9

SUBSIDENCE RATES OF THE DELTA ISLANDS

(3.0) depth in inches per year

SOURCE: Department of Water Resources, "Delta Subsidence," June 1978

Subsidence cannot be stopped, but it can be slowed down. It is estimated that under ideal conditions, with maximum controls, the present rate of subsidence could be reduced by about 40 percent. The interrelationships between the factors causing subsidence and the possible control measures are complex and the benefits of a given control measure may be offset by the tendency to indirectly increase subsidence.

Exhibit II-10 summarizes the agricultural practices which can be used for subsidence reduction. Control of the ground water level and mitigation of wind erosion have the most chance of success. Use of these methods could mean major changes in Delta farming. For example, if the ground water level were kept high, only shallow root crops, such as grasses, grains, and clover, could be grown. In addition, high water tables could cause tillage problems, result in higher salt levels in the soil (already a problem), and limit vehicular travel.

Wind erosion control measures, such as inter-row planting, planting of trees for wind breaks, could reduce the amount of productive agricultural land but could have numerous benefits in addition to the reduction of soil loss.

Despite the problems with the use of control measures, without them subsidence can be expected to continue at existing rates and Delta farming will be increasingly limited. In time, the costs of maintaining the levees and the ground water level may exceed the income received from farming. The future of the Delta is therefore questionnable.

The fate of the islands is of public concern. The contribution of Delta agriculture to the economy of the county and the state is large, and the importance of the Delta is not limited to agriculture, although what happens to Delta agriculture affects other Delta resources, such as recreation, fisheries, wildlife, shipping, and the state water supply. Studies on the Delta, particularly on the levees, are now being conducted be the State Department of Water Resources and the U.S. Corps of Engineers. These studies should be completed in 1980 and should result in recommendations for individual and public actions that will determine the Delta's future.

Subsidence by Seismic Activity

Earthquake motion can cause localized subsidence by a settlement or "shake-down" of the soils. This settlement is most likely to take place in areas where the water table is deep (otherwise liquefaction could take place), the soils are of loose to medium density, and the soil profile includes a strata of loose, clean, uniformly graded sand. Insufficient data exists to make definite outlines of areas where "shakedown" is likely to occur. In general, the Lodi-Thornton areas and areas southwest of Tracy are likely places for "shakedown" to occur due to sandy soils. Also, the Manteca-Lathrop-French Camp area could be subject to "shakedown" during periods of low groundwater levels.

As with liquefaction, the potential for ground settlement in an earthquake is dependent upon the magnitude, duration and frequency of the earthquake waves. The long rolling earthquake motion, which is most apt to occur in San Joaquin County, would be less likely to cause "shakedown" than would intensive high frequency motion. Therefore, the potential for seismically induced ground subsidence can be considered relatively low for San Joaquin County (4).

CAUSES AND CONTROL FOR DELTA SUBSIDENCE

(Preliminary - Subject to Revision)[1]

Cause	Relative Importance (1 to 10 Scale) Least-Most	Control Method	Means of Implementing the Control Method
		Found Generally Over Most of Delta	
Oxidation, natural	1 0	Water Level Control Maintain high water levels Soil Disturbance Control Minimize disturbance	Selective crops and land use designed to maintain high water levels and for minimum soil disturbance
Anaerobic Decomposition	7	Water Level Control Prevent wetting and drying	
Shrinkage (Dewatering)	6	Water Level Control Maintain high water levels	
Wind Erosion (Deflation)	1	Wind Breaks Cut wind velocities Soil Disturbance Control	Trees, wind break fences, special plants, roughen surface. Do not disturb soils during windy periods, cover crops, use herbicides. Orient crop rows perpendicular to wind. Do strip cropping, use mulches, use spray or adhesives.
Tectonic Movement	0.1	No Control	--
Compaction (Near surface from farm equipment)	Practically Zero	No Control	--
		Found Only in Certain Delta Areas	
Consolidation (Natural)	3	No Control	--
Consolidation (Gas, water removals)	1	Control of Production Repressure Strata	Limit production Reinject fluids and gas
Burning	0.7	Stop Burning	--
Export by Man	Probably <0.1	Export Control	Wash plants Prohibit mining of soils

[1] Source: California Department of Water Resources. Delta Subsidence, Preliminary Report, June, 1978

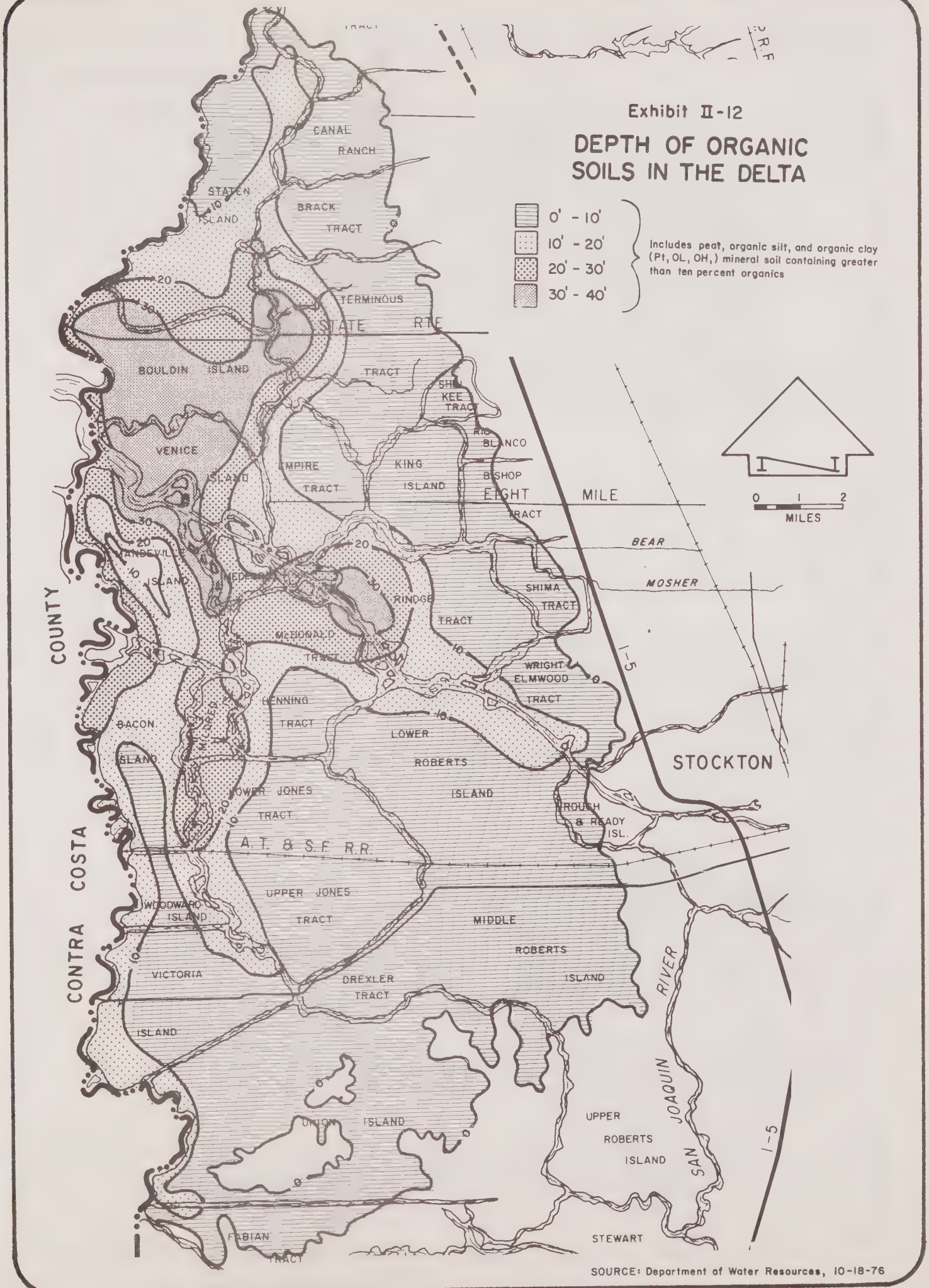
Exhibit II-11

PROBABILITY OF DELTA LEVEE
STABILITY FAILURE

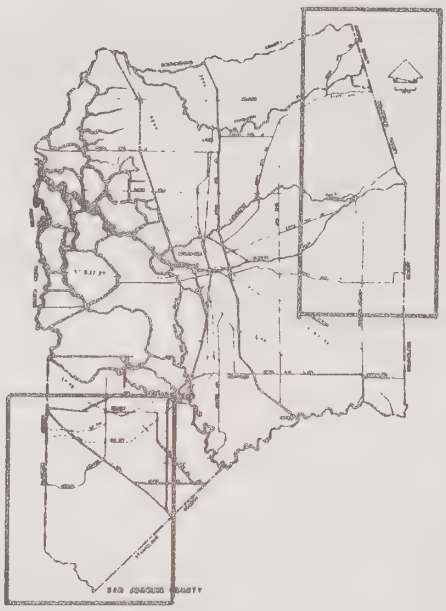
ISLAND OR TRACT	PROBABILITY OF STABILITY FAILURE WITHIN NEXT 40 YEARS[1]
	Percent Chance
Bacon	2.0
Bouldin	8.2
Brack	1.2
Empire	0.7
Fabian	0.44
Jones (Upper & Lower)	2.1
King	1.3
Mandeville	0.17
McDonald	1.1
Medford	2.0
Mildred	4.0
New Hope	0.44
Rindge	3.0
Roberts (Lower)	0.09
Roberts (Middle)	0.61
Shima	0.068
Staten	~ 3.0
Stewart	~ 1.4
Terminous	2.0
Union	0.84
Venice	4.4
Victoria	2.8
Woodward	3.0
Wright	0.12

[1] If subsidence is not remedied or mitigated.

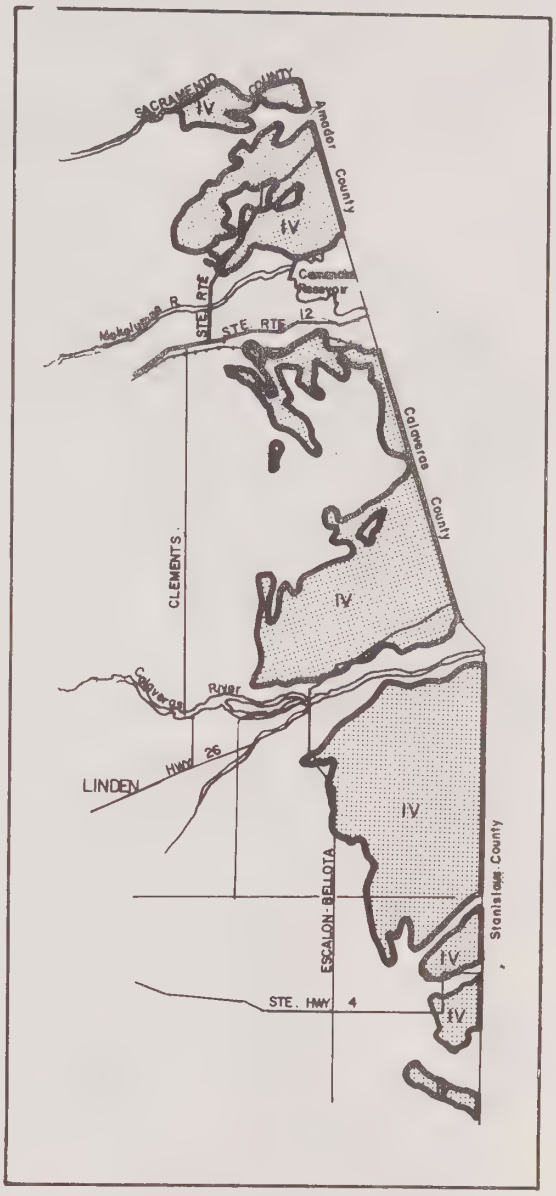
Source: W.N. Houston and J.M. Duncan, Probability of Failure of Levees, study conducted under contract with the Corps of Engineers, Sacramento, Ca., February 17, 1978, Table 4, pp. 11-12. (Note: This study is preliminary and subject to revision.)



SOURCE: Department of Water Resources, 10-18-76



"B"



"A"

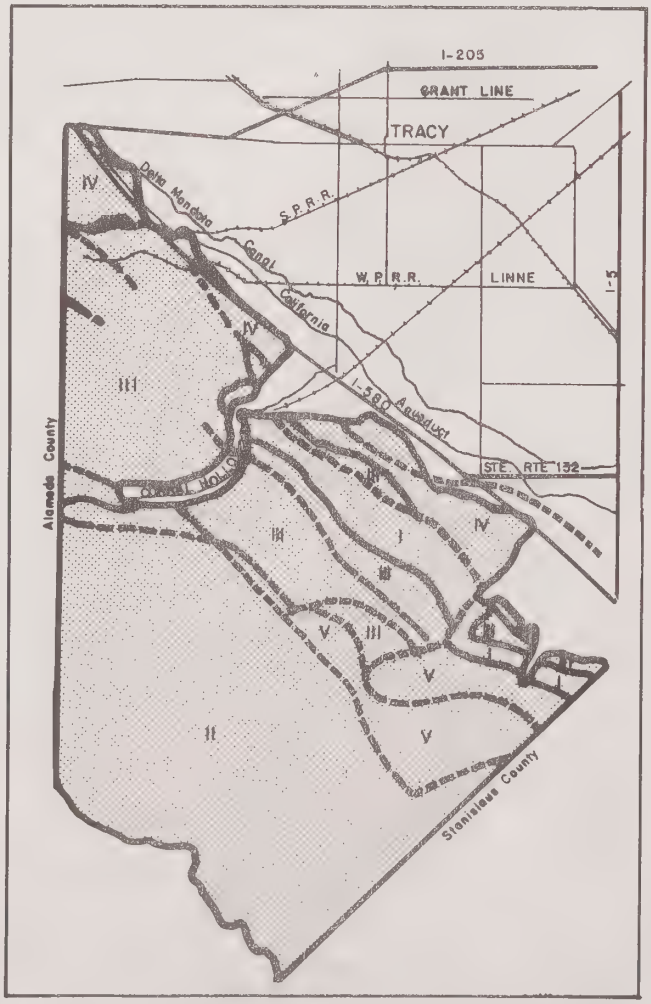


Exhibit II-13

AREAS SUBJECT TO LANDSLIDES

landslide suseptability rating	% of the area in which landslides have been identified
I	20%
II	12 %
III	8 %
IV	4 %
V	1 %

Source: San Joaquin County Council of Goverments Seismic Safety Element, 1973

Slope Instability(2)

The downslope movement of earth materials, often referred to as mass movements (creep, mudflows, landslides, rockfalls, etc.), is a normal geologic process by which slopes are flattened and valleys are widened. The rate of downslope movement ranges from very rapid rockfalls, to very slow, imperceptible soil and bedrock creep. Almost all slopes are involved in some form of mass movement. Although most of these movements are considered to be minor or insignificant, there are areas where slope failures pose a major geologic problem. Early recognition of areas susceptible to large scale movement can significantly reduce the threat of damage and injury in the land use planning and design process. It is therefore, important to identify terrain subject to slope instability so that proper land utilization can be assured.

Slope stability problems within San Joaquin County are mostly confined to three areas: 1)the foothills and mountain terrain which border the San Joaquin Valley, 2)the steep banks of the major rivers which cut into the floor of the Valley, and 3)the levees of the Delta. The instability of the Delta levees has already been discussed.

The areas of San Joaquin County most susceptible to unstable slope conditions are the steep hills of the Diablo Range in the southwest section of the County and the Sierra Nevada Foothills along the County's eastern edge (Exhibit II-13). Combined, the two areas equal about 20% of the total area of the County. The major contributing factors are steep slopes, weak earth materials, adverse bedrock structures and ground-water problems. No urban development is planned in those areas which are subject to landslides.

Small scale slope failures along steep river embankments, although not of great countywide significance, could be significant in local areas. Where major streams have cut sharp banks into the valley floor, undercutting or over-steepening their banks, local unstable slope conditions are created. These steep banks will retreat and flatten their slopes through natural slope failures until an equilibrium is reached. These localized slope failures do not pose great hazards as long as building does not take place along the unstable river banks.

Expansive Soils

Expansive soils are soils which swell when they absorb water and shrink as they dry. Clay soils are primarily affected. The basic cause of expansion is the attraction and absorption of water in the expandable crystal structures of clays. When buildings are placed on expansive soils, foundations rise during wet periods and fall during dry periods. Different parts of a building may rise and fall at varying rates to cause foundation cracking. Various structural portions of a building may become distorted so that doors and windows do not function properly.

The areas of San Joaquin County with the greatest shrink-swell soil problems are the Delta, the areas north and west of Tracy, the Stockton-French Camp area, and the area east of French Camp and Stockton as far as Farmington (6) (Exhibit II-14).

Hazards of expansive soils can be avoided through proper drainage and foundation design, if soil characteristics are recognized through appropriate tests. The State Subdivision Map Act requires soil reports for all major subdivisions (23).

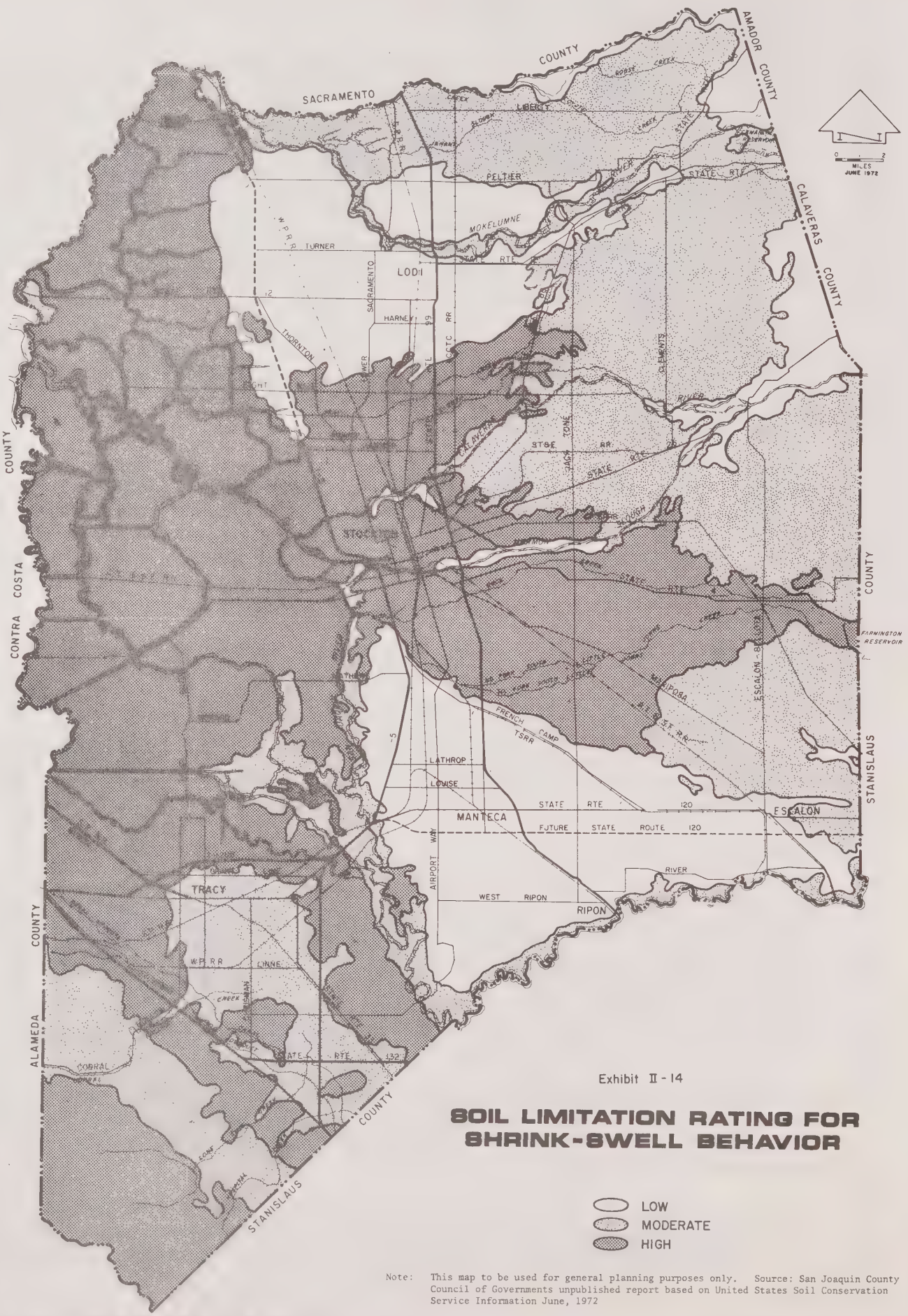


Exhibit II - 14

SOIL LIMITATION RATING FOR SHRINK-SWELL BEHAVIOR

LOW
MODERATE
HIGH

Note: This map to be used for general planning purposes only. Source: San Joaquin County Council of Governments unpublished report based on United States Soil Conservation Service Information June, 1972

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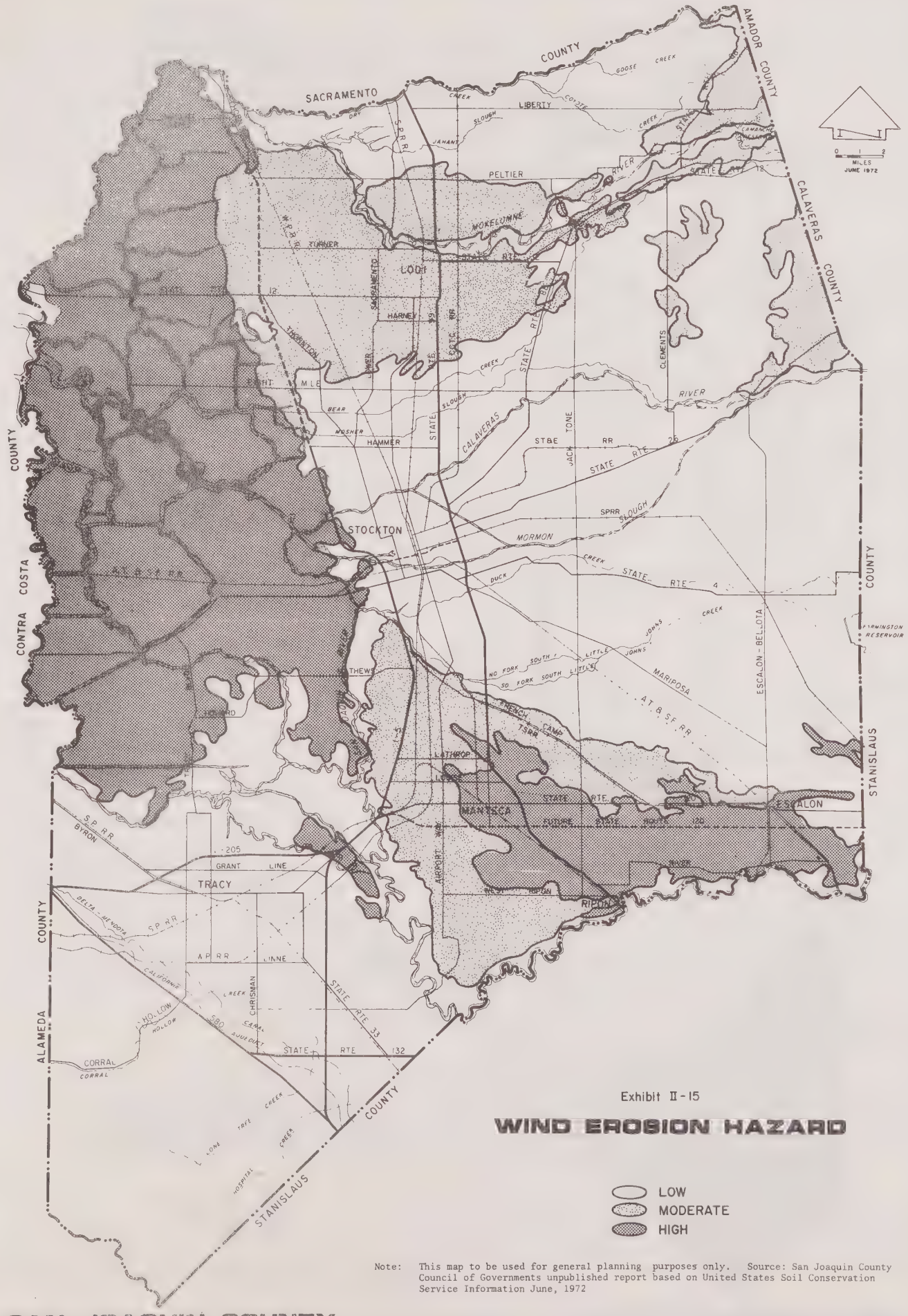


Exhibit II-15

WIND EROSION HAZARD

LOW
MODERATE
HIGH

Note: This map to be used for general planning purposes only. Source: San Joaquin County Council of Governments unpublished report based on United States Soil Conservation Service Information June, 1972

SAN JOAQUIN COUNTY

SAN JOAQUIN COUNTY PLANNING DEPARTMENT

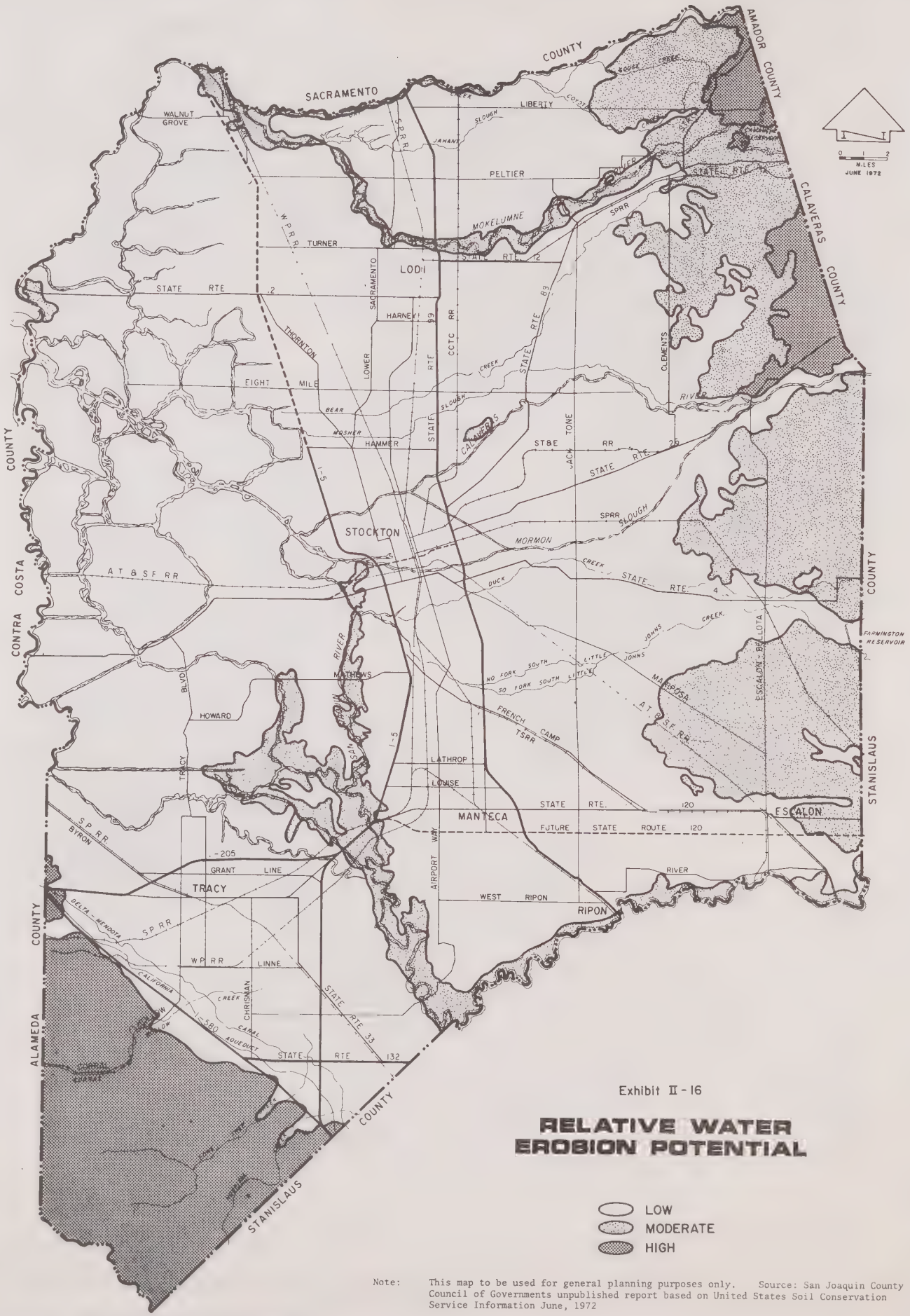


Exhibit II-16

RELATIVE WATER EROBION POTENTIAL

LOW
MODERATE
HIGH

Note: This map to be used for general planning purposes only. Source: San Joaquin County Council of Governments unpublished report based on United States Soil Conservation Service Information June, 1972

SAN JOAQUIN COUNTY

SAN JOAQUIN COUNTY PLANNING DEPARTMENT

Once expansive soils have been recognized, corrective measures can be designed into the foundation for little extra cost.

Erosion

Erosion is the process of detachment and transportation of soil particles by wind and water. Erosion can pose a hazard to continued agricultural production in certain areas of San Joaquin County. In addition, sediments can harm water quality and pose health hazards.

There are two areas of San Joaquin County subject to wind erosion, the Delta and the Manteca area east to the county line. Erosion of peat soils has been discussed as one cause of subsidence. During times of high winds (15+MPH), clouds of peat dust can be seen in the Delta. This dust is a health and safety hazard and contributes to the loss of agricultural soils. At times, roads through the Delta must be closed due to poor visibility in a peat "storm." The blowing dust presents a continual cleaning expense in a large part of the County.

Water erosion at varying rates is taking place in the Delta and in the foothills in the southeast and eastern sections of the County due to combinations of loose soils, steep slopes and a high rate of runoff (6). Erosion reduces the ability of the Delta levees to withstand water pressure and increases the potential for failure and flooding. This erosion is caused by tidal action, wind induced waves and boating. Levee maintenance becomes a major problem because of the erosion. (See Chapter III, Flood Hazards.)

STRUCTURAL DAMAGE AND PREVENTIVE MEASURES

Seismic activity poses the greatest geologic hazard to buildings in the County. Fortunately, seismic understanding has increased greatly in recent years, and since an impetus has been exerted by the 1971 San Fernando Valley earthquake, many changes have been made in structural standards and in determinations of seismic risk.

The Uniform Building Code now places all of San Joaquin County in Earthquake Zone 3. The regulations for this zone are based on the assumption that an earthquake of an intensity of VIII+ on the Mercalli Scale could occur.

Earthquake-resistant design and construction of new man-made structures is by far the most effective and practical approach to the problem of preventing or reducing loss of life, injury, and property damage, and disruption of the economy caused by earthquakes. However, there is also general agreement among seismic safety experts that an urgent need exists for measures to minimize the serious earthquake hazards which exist in many older buildings.

There are old buildings in the County that are still in use which were designed without calculated earthquake resistance. Most of these were built prior to 1933. Those constructed since that time have various degrees of earthquake resistance built into them. In the 1952 Bakersfield quake, post-1933 structures held up fairly well, while pre-1933 buildings were badly damaged.

Section 203 of the Uniform Building Code deals with "dangerous buildings" and allows local government to declare such buildings a public nuisance and abate them. Some communities have appointed knowledgable committees to make

Exhibit II-17

Hazard Comparison of Non-Earthquake Resistive Buildings

	Simplified Description of Structural Type
Safest	Small wood-frame structures, i.e., dwellings not over 3,000 sq. ft. and not over 3 stories
	Single or multistory steel-frame buildings with concrete exterior walls, concrete floors, and concrete roof. Moderate wall openings
	Single or multistory reinforced-concrete buildings with concrete exterior walls, concrete walls, and concrete roof. Moderate wall openings
	Large area wood-frame buildings and other wood frame buildings
	Single or multistory steel frame buildings with reinforced masonry exterior wall panels; concrete floors and concrete roof
	Single or multistory reinforced-concrete frame buildings with unreinforced masonry exterior wall panels, concrete floors and concrete roof
	Reinforced concrete bearing walls with supported floors and roof of any material (usually wood)
	Buildings with unreinforced brick masonry having sand-lime mortar; and with supported floors and roof of any material (usually wood)
Most Dangerous	Bearing walls of unreinforced adobe, unreinforced hollow concrete block, or unreinforced hollow clay tile

(Table intended for buildings not containing earthquake bracings, and in general, is applicable to most older construction. Unfavorable foundation conditions and/or dangerous roof tanks can increase the earthquake hazard greatly.)

Source: Ripon Seismic Safety Element (2)

the decisions in such cases. Although abatement is a wise policy, many jurisdictions have avoided this option because of the economic consequences and have concentrated on reducing the hazard of older buildings rather than removing them.

In an earthquake, the most hazardous parts of a building generally are unreinforced masonry units. The following excerpt from the Contra Costa County Seismic Safety Element explains how such building parts have fared in previous earthquakes.

> "Parapets and Chimneys. Probably the greatest loss of life from earthquakes has resulted from the failure of unreinforced unit masonry. particularly unreinforced brick parapets on commercial buildings. Persons on the streets or inside buildings are often injured by such falling masonry. Chimneys can also be a great hazard in houses and small apartments.
>
> Signs and Appendages. Signs, marquees, cornices, canopies and general ornamentation extending out from buildings pose a great potential hazard in earthquakes if not adequately anchored to the building.
>
> Facades. Two kinds of hazards can be caused by building facades. Masonry veneer facades inadequately anchored, can be shaken loose by an earthquake, causing danger similar to parapets. On the other hand, open glass facades as on stores, can cause amplified twisting to the building and shattering of glass on the sidewalk." (10)

Many jurisdictions are requiring reinforcement of parapets, cornices and other ornamentation.

The Hazard Comparison Table (Exhibit II-17) shows the relative safety of various types of buildings in an earthquake. The safest are one-story, small, wood frame buildings. The most hazardous are unreinforced brick, adobe, hollow concrete block or hollow clay tile.

EARTHQUAKE PREPAREDNESS

There are many things a citizen or a community can do to prepare for an earthquake to diminish the effects of an earthquake. Unlike most other natural disasters, such as floods or fires, earthquakes give no warning. It is, therefore, imperative that an individual have a basic understanding of the recommended actions to take prior to, during, and after an earthquake.

Exhibit II-18 is a list of what to do before, during, and after an earthquake was originally published by the California Division of Mines and Geology (21).

Exhibit II-18

EARTHQUAKE SAFETY TIPS

BEFORE

1. Store emergency supplies: food, water, first aid kit, flashlight and battery-powered radio.
2. Take a practical first aid course.
3. Locate main switches and valves that control the flow of water, gas, and electricity into your house. Know how to operate them.
4. Support community programs that inform the public and emergency personnel about earthquake preparedness.
5. Take action to help strengthen or eliminate structures that are not earthquake-resistant.
6. Support "parapet ordinances" that would remove dangerous, unreinforced overhangs and cornices from buildings.
7. Support building codes that require earthquake-resistant construction and careful foundation preparation and grading.
8. Support land use policies that recognize and allow for the potential dangers of active fault zones.
9. Heavy furniture above the fifth floor in tall buildings should be bolted to the floor.
10. Require guard rails across the inside of plate glass windows that extend to the floor.
11. Support basic research into the cause and mechanism of earthquakes and fault movement.

DURING

1. Don't panic even if you are frightened.
2. If you are indoors, stay there. Get under a desk, table, or doorway.
3. Do not rush outside. Falling debris has caused many deaths.
4. Watch for falling plaster, bricks, and other objects.
5. If you are outside, move away from buildings and power lines; stay in the open.
6. If you are in a moving car, stop as soon as it is safe. Remain in the car.

AFTER

1. Check your family, or the people near you for injuries.
2. Inspect your utilities for damage to water, gas, or electrical conduits. If they are damaged, turn them off.
3. Extinguish open flames.
4. Do not use the telephone except to report an emergency.
5. Turn on your battery-powered radio for emergency information.
6. Don't go sightseeing.
7. Stay away from damaged structures; aftershocks can cause the collapse of weakened structures.
8. Stay away from beaches and waterfront areas subject to seismic sea waves (commonly called "tidal waves").

Source: California Geology, Nov. 1971(21).

CHAPTER III

FLOOD HAZARDS

PRINCIPLES

1. Undeveloped areas subject to a 100 year flood should not be planned for urban development.

2. No new urban development should be permitted unless it is protected from a 100 year flood.

3. Levees and flood channel improvements in urbanized areas should be brought up to 100 year flood protection.

4. The County shall work toward 50 year flood protection for non-urbanized areas.

5. The County shall encourage and support current studies of Delta levee stability and an improvement program to provide a satisfactory level of flood protection for the Delta's agricultural and recreation uses and for West Stockton's urban uses.

6. Illegal structures built on unleveed tule islands should be abated.

7. Only water-dependent structures shall be permitted in the floodway.

8. Flood hazard reports should be requested from the Corps of Engineers for projects in any areas where the possibility or amount of flooding is uncertain.

9. In order to maintain the availability of flood insurance and decrease the potential for financial loss, the County shall continue to participate in the National Flood Insurance Program.

10. The County will promote ongoing monitoring programs of all upstream dams by the appropriate agencies.

11. In areas where the County Building Inspector identifies a severe drainage problem, all new residential dwellings shall have the floor level six (6) inches above the crown of the nearest County road.

IMPLEMENTATION ACTIONS

1. The County should ensure that the Delta Levee Investigation, being conducted by the Federal and State governments, includes analysis of levee failure by liquefaction. (Planning, Reclamation Districts)

2. In order to minimize levee erosion, the possibility of "waterway zoning" and a system of speed limitations on the County's waterways should be examined by the County as part of Delta levee studies. (Planning, Sheriff's Department)

3. Flood hazards and required protection measures should be noted on parcel and subdivision maps. (Planning)

4. As required by participation in the National Flood Insurance Program, flood plain zoning and other appropriate flood protection measures should be adopted. (Planning)

5. Brochures regarding methods of flood hazard reduction should be prepared. (Planning, Public Works, Building)

INTRODUCTION

Definition of Flooding

A flood is a temporary rise in a watercourse flow, or an alteration of watercourse boundaries, that results in water overtopping or breaching its banks or levees and inundating areas adjacent to the normal channel. Floods have been viewed as erratic forces of nature dependent on the unpredictability of rainfall and snowfall. The rivers and flood plains were formed by nature as drainage channels for flood flows resulting from heavy snowmelt or rainfall. Floods follow natural topographic contours. Floods have always existed; they have caused damage only when man settled in flood plain areas.

Factors Influencing Flooding(13)

Natural	Man-Made
accumulated snow and its moisture content	land uses
rate of snowmelt	changes in drainage
temperature	reservoir capacity
amount, timing, and duration of rains	reservoir releases
month of the year	changes in watercourses
topography	paving of surface areas
soils and geology	levee height
drainage patterns	levee design and stability
sediment deposition	
capacities of watercourses	

Flood hazards in San Joaquin County are the result of either extremes of the hydrological cycle, such as intense rain, snowmelt and cloudbursts, or failure of a hydrological control structure, such as dam failure, levee failure, lack of adequate capacity of a drainage channel to handle runoff or flow, or blockage of drainage channels. The majority of the County could be affected by one or more of these hazards.

Effects of Flooding

A flood can cause destruction in a variety of ways. The initial force of flood waters can shatter structures and uplift vehicles, thus clearing a path in its wake. The movement of the waters can carry objects of large proportions downstream and exert a lateral force, becoming battering rams against stationary structures. Saturation of materials and earth can cause instability, collapse and damage. Floodwaters pick up soils and sediment and through the redeposit of sediment, objects can be buried. Floods cause drowning of persons and animals or isolation of persons and animals. Floodwaters can break utility lines such as telephone, electric, gas, water, and sewer lines, indirectly affecting health. The combinations of these effects underscore the devastative primary effects of floods.

The secondary effects of floods are attributable to standing water. There are many areas in San Joaquin County where a flood will result in ponding of one to three feet. This water may cover the ground for weeks depending upon weather conditions. This will cause loss of crops and delays in planting. Standing water will cause septic tanks to fail. Older small wells may become contaminated. Standing water can also cause damage to or hazard from electrical circuits, telephone lines, roads and structural foundations.

The values of waterways for water supply, fisheries, and recreation are well known, and San Joaquin County is well endowed with watercourses, as indicated by Exhibit III-1. However, extremes of rainfall and snowmelt will continue to turn one of San Joaquin County's primary resources into a threatening force of major proportions. The costs associated with floods are significant. According to the Water Resources Council the cost of property lost or damaged in the United States in 1975 due to flooding was 3.4 billion dollars.(1)

Methods to Reduce Flood Damage

There are a number of ways to minimize flood damage. In California the emphasis has been on control of the flood waters. In San Joaquin County the majority of the waterways are leveed, but nevertheless, the possibility of flooding is a concern in all bu the driest years.

Methods to Reduce Flood Damage(13)

Control of the Water	Control of the Land	Other
reservoirs	flood plain zoning	floodproofing
levees or flood walls	building codes	evacuation
channel improvement	subdivision regulations	urban redevelopment
bypasses or diversions	development policies	flood insurance
watershed management	open space maintanance	tax adjustments

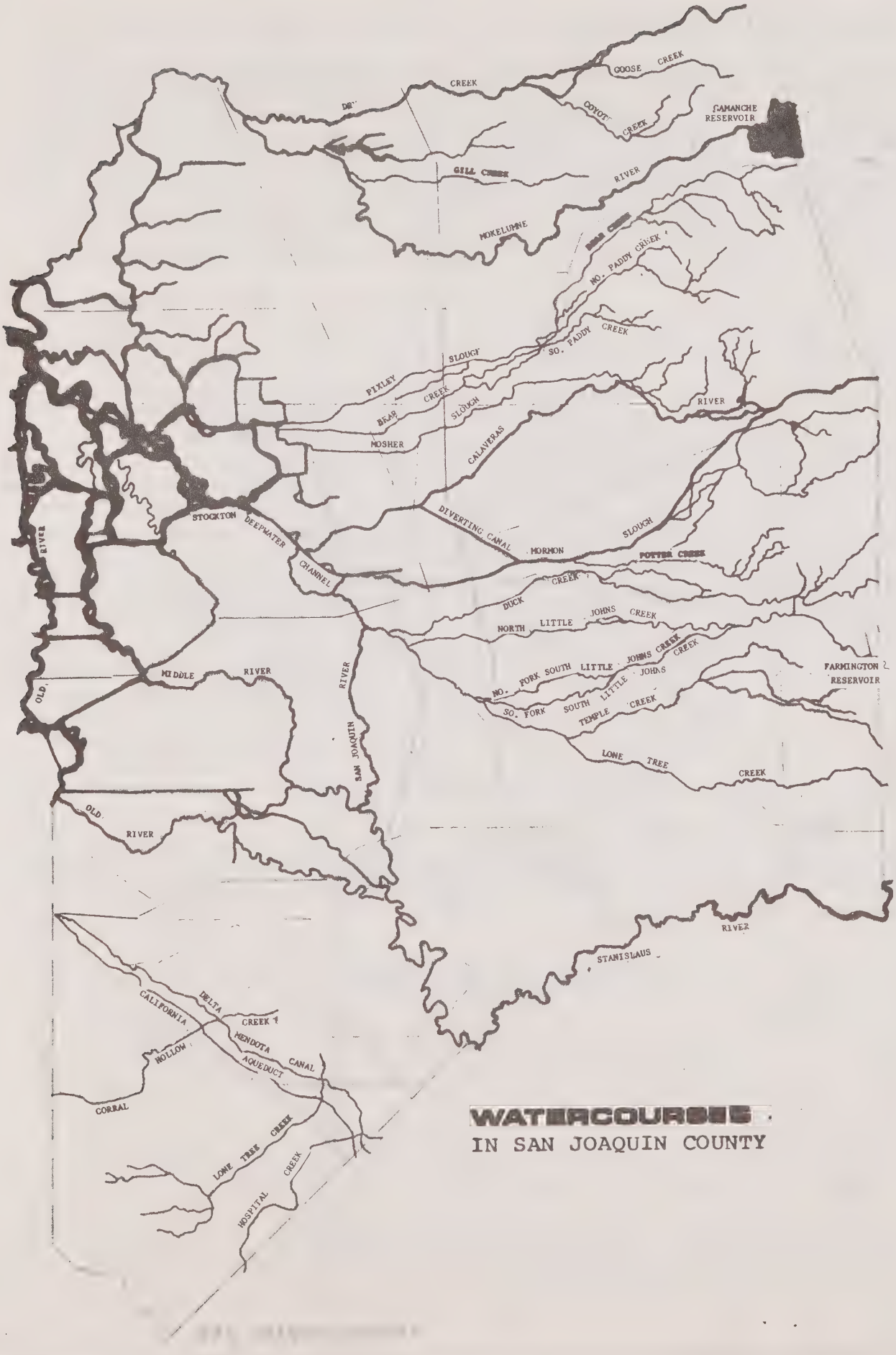
HISTORY OF FLOODING IN SAN JOAQUIN COUNTY[1]

San Joaquin County has a long history of floods. From Indian legends, the journals of Spanish explorers, and accounts of early-day settlers, it is known that widespread flooding occurred in the County in 1776, 1805, 1826, 1828, and 1830. The first flood mentioned in historical accounts of the area occurred in 1847. Records show that nine major and eight minor floods occurred during the last half of the nineteenth century. Of the major floods, one that occurred in 1861-62 was the greatest known in the region. Stages six to 15 feet higher than those of earlier floods were reported on all major waterways and sustained record breaking stages were reached several times during the season. Melting snow upstream augmented rainflood runoff.

Thirty-two rainflood periods and seven significant snowmelt flood events in San Joaquin County are documented for the 66-year period of 1903-1969. In general, rainfloods that occurred in November and December 1950 and in December, 1955 were the most damaging recent rainfloods known in the County.

[1]This section has been excerpted from the Flood Insurance Study for San Joaquin County (2).

EXHIBIT III-1



WATERCOURSES
IN SAN JOAQUIN COUNTY

Rivers of the San Joaquin Basin

The San Joaquin River is the principal stream in San Joaquin County and in the southern half of the Central Valley. Excluding the Tulare Lake Basin, San Joaquin County is subject to runoff from more than 9,000 square miles of tributary area. The major tributaries flowing from the east and southeast are the Mokelumne, Calaveras, Stanislaus, Tuolumne, Merced, Chowchilla and Fresno rivers. Less significant eastside tributaries comprise the Bear Creek system, French Camp Slough (Duck and Little John's Creek systems) and the Merced County Stream Group (Bear, Burns, Owens and Mariposa Creeks). The principal westside tributaries are Corral Hollow, Panoche, Los Banos, San Luis and Orestimba Creeks (2).

Natural Hydrological Cycle Extremes

General rainfloods can occur in San Joaquin County anytime during the period from November through April. This type of flood results from prolonged heavy rainfall over tributary areas and is characterized by high peak flows of moderate duration. Flooding is more severe when the ground in tributary areas is frozen and infiltration is minimal, or when snowmelt in the high elevations adds to rainflood runoff. Snowmelt floods on the San Joaquin River and its higher elevation tributaries can be expected to occur during the period April through June. Although snowmelt flooding is of much larger volume and longer duration than rainflooding, it does not have the high peak flows characteristic of rainfloods. Snowmelt flood runoff is sometimes augmented by late spring rains on the snowfields or lower elevation tributary watersheds. Cloudburst storms sometimes lasting as long as three hours can occur over drainage basins in or tributary to San Joaquin County anytime from late spring to early fall, and may occur as an extremely severe sequence within a general rainstorm. Cloudbursts are high intensity storms that can produce floods characterized by high peak flows, short duration of floodflow, and small volume of runoff. Cloudburst storms are usually small in areal extent and would not affect floodflows or flood stage on the San Joaquin, Mokelumne, or Calaveras Rivers.

The following table lists recent San Joaquin County floods and their frequencies. "Frequency" indicates how often a flood of the magnitude would be expected to occur.

Frequencies of Past Floods(2)

Stream	Flood	Frequency* (years)
San Joaquin River	1950	75
	1955	50
Mokelumne River	1950	20
	1955	20
Bear Creek System	1955	5
	1958	40
Calaveras River	1950	30
	1955	70
Little John's Creek System	1955	15
	1958	60

*At time of flood

Hydrological Control Structures for Flood Protection

Protective work systems designed for comprehensive hydrological control are traditional methods for minimizing the effects of floods. These methods include a)construction of drains and reservoirs in upstream areas to reduce flood heights by retaining and gradually releasing water which, if unimpeded, would swell rivers beyond their channel capacity, b)construction of levees or flood walls which confine waters to the channel or designated areas and c)designing channel improvements to increase the stream's capacity to carry flood waters by diverting, straightening, deepening, widening, clearing or lining the stream channel.

Since San Joaquin County lies at the terminus of the principal river draining the southern half of the Central Valley, the County is afforded flood protection directly or indirectly by every flood control storage project in the region. Exhibit III-2 provides a summary of the storage projects (dams) affecting flood flows in San Joaquin County.

All of the major streamways and most of the lesser creeks in San Joaquin County are leveed. Most levees are maintained by various Reclamation Districts, adjacent property owners, or the County Flood Control District (Exhibit III-3). Some levees along the San Joaquin River, are maintained by the Federal Government. Exhibit III-22 provides an additional summary table of major flood control structure characteristics and effects in event of a structure failure. Other flood protection projects include the Mormon Slough-Diverting Canal Project, Mosher Slough Project, Duck Creek Diversion Project and San Joaquin levee improvements. These projects are described in stream group reports prepared by the Sacramento District Army Corps of Engineers (14,15,16,17). The Corps is presently studying the Lower San Joaquin for possible additional flood protection(4).

Degrees of Protection

No area can be completely protected from flooding. The construction of flood control projects will increase the level of protection and reduce the frequency of flooding; however, some risk of flooding will remain. Causes of major flooding include storms and snowmelts in excess of flood protected capacity, failure of minor flood control structures, such as levees, and failure of major flood control structures, such as dams.

Floods along a single stream are compared in terms of their frequency of occurrence, which is indirectly related to the discharge. Rainfall and snowmelt floods are often referred to as 10 year, 20 year, 50 year, 100 year and 500 year floods. A 10 year flood means that the flood with a given magnitude has a ten percent (10%) probability of occurring in any year. If a stream has been improved to 50 year protection, it will therefore safely contain up to a 50 year flood but not beyond a 50 year flood.

An additional factor is the degree of protection necessary for any given area. Since flood control projects are costly, the degree to protection should be commensurate with the degree of acceptable risk and potential damage.

In many agricultural areas flooding is necessary to replenish soil nutrients. Where no structures or intensive crops are located in the flood plain, the

Storage Projects Affecting Floodflows In San Joaquin County

Name	Stream	Operating Agency[1]	Flood Control Reservation acre - feet Rainflood Season	Flood Control Reservation acre - feet Snowmelt Flood Season	Status
Camache Reservoir	Mokelumne River	East Bay Municipal Utility District	200,000	200,000	Completed in 1964
New Hogan Lake[2]	Calaveras River	Corps of Engineers	165,000	-[3]	Completed in 1964
Farmington Dam	Littlejohns Creek	Corps of Engineers	52,000	-[3]	Completed in 1951
New Melones Lake	Stanislaus River	Bureau of Reclamation[4]	450,000	450,000	Operational in 1978, completion in 1979
New Don Pedro Reservoir	Tuolumne River	Local Interest Group[5]	340,000	1,000,000	Completed in 1971
Lake McClure (New Exchequer Dam)	Merced River	Merced Irrigation District	350,000	400,000	Completed in 1966
Buchanan Dam (H.V. Eastman Lake)	Chowchilla River	Corps of Engineers	45,000	-[3]	Operational in 1975, completion in 1977
Hidden Dam (Hensley Lake)	Fresno River	Corps of Engineers	65,000	-[3]	Operational in 1975, completion in 1977
Millerton Lake (Friant Dam)	San Joaquin River	Bureau of Reclamation	170,000	390,000	Completed in 1949
Pine Flat Lake	Kings River	Corps of Engineers	475,000	1,000,000	Completed in 1954

[1] Rules and regulations for flood control operation of the projects shown are prescribed by the Corps of Engineers regardless of the operating agency (Section 7, 1944 Flood Control Act--Public Law 78-534).

[2] The present project comprised enlargement of an existing reservoir owned and operated by the City of Stockton

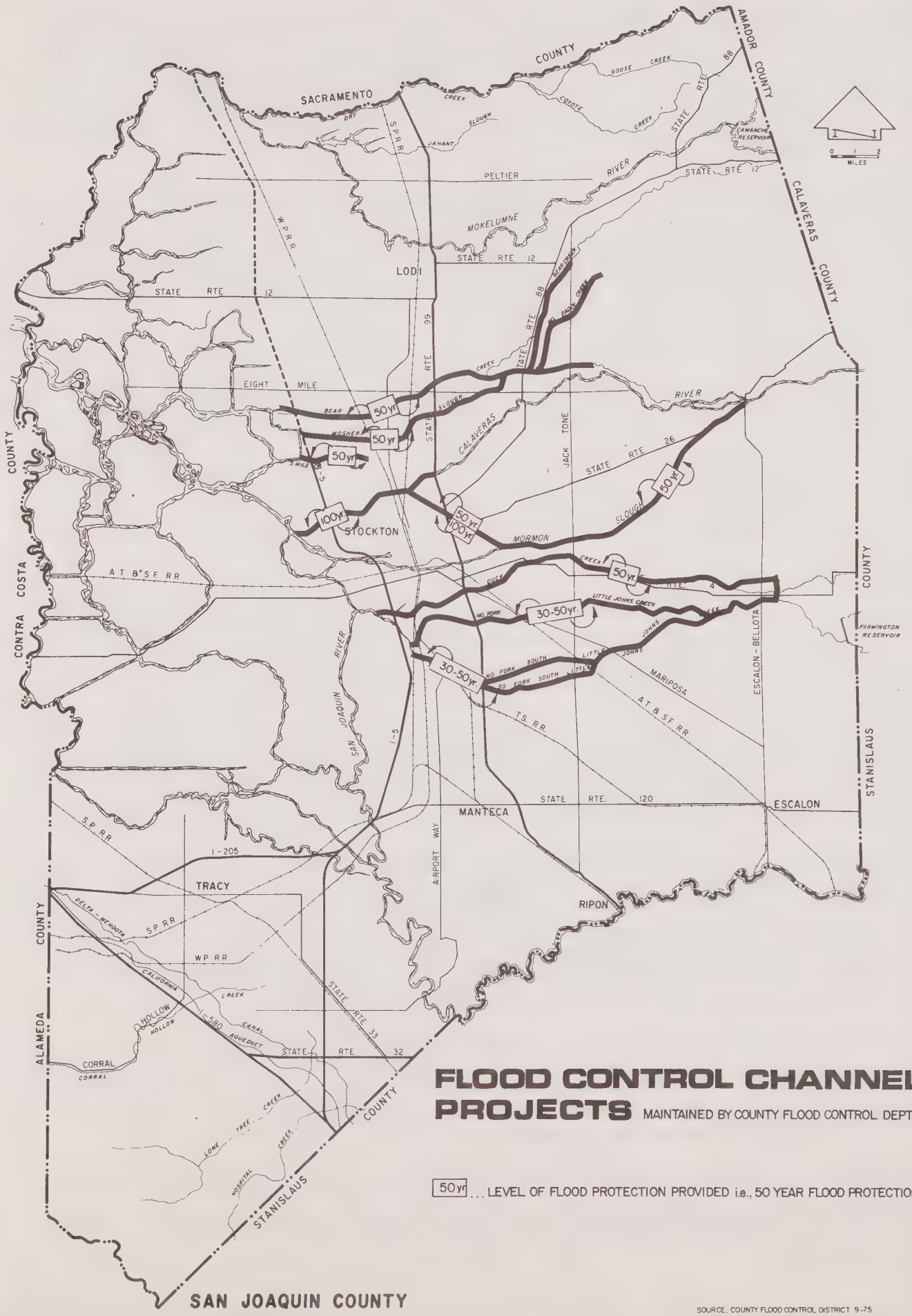
[3] Not Applicable

[4] The project will be built by the Corps of Engineers. On completion, it will be transferred to the Bureau of Reclamation for operation and maintenance as a unit of the Central Valley Project.

[5] The City and County of San Francisco and the Turlock and Modesto Irrigation Districts.

From: Federal Insurance Administration: Flood Insurance Study, November, 1977(2).

EXHIBIT III-3



FLOOD CONTROL CHANNEL PROJECTS MAINTAINED BY COUNTY FLOOD CONTROL DEPT.

50yr ... LEVEL OF FLOOD PROTECTION PROVIDED i.e., 50 YEAR FLOOD PROTECTION

SOURCE: COUNTY FLOOD CONTROL DISTRICT 9-75
SAN JOAQUIN COUNTY COUNCIL OF GOVERNMENTS

levels of protection afforded by the natural flood plain may be sufficient. In intensive agricultural areas with scattered structures, 50 year flood protection is generally accepted. Where urban development has encroached into the natural floodplain, the necessary extent and degree of protection rises dramatically to protect development. Therefore, a desired degree of protection must be considered in the terms of the cost and the protection needed for development.

Flood control projects in the Stockton vicinity have been designated to provide protection against floods at a 50 year minimum. Exhibit III-3 indicates levels of flood protection in the Stockton area. In some cases, the levees will not be overtopped even in a 100 year flood, but since they were designed for 50 year protection, they may fail if they have to contain higher water for a long period. (See page III-25).

FLOOD HAZARD IN SAN JOAQUIN COUNTY

There are four types of floods and hazard considerations that are related to flooding in San Joaquin County:

1. 100 year flood
2. Levee failure
3. Localized drainage problems
4. Dam failure

100 Year Flood Hazard

As described previously, a 100 year flood has a specified magnitude that has a one percent probability of occurring in any year. This is considered to be a severe flood, but one with a reasonable possibility of occurrence for purposes of land use planning, property protection, and human safety.

As part of the County's participation in the National Flood Insurance Program, the Corps of Engineers, under contract to the Flood Insurance Administration, prepared a series of maps depicting 1)location of the 100 year flood, 2)flood elevations, 3)floodways, 4)500 year flood boundaries, and 5)flood insurance rate zones.[1] Exhibits III-4 to III-15 show the 100 year flood hazard areas.

Two methods of study were used by the Corps in preparation of the maps. In planned urban areas the detailed method was used. Hydrologic analyses were conducted, using the Corps of Engineers standard project rainfall and flood concept, the unit hydrograph method of analysis, statistical analysis of streamflow data and consideration of current operating criteria for upstream reservoirs. Hydrologic analysis required for the mapping involved 10 year, 50 year, 100 year and 500 year flood data for streams.[2]

Rural areas were studied by the approximate method, which consisted of inspections and topographic analyses. These rural areas included most of San Joaquin Delta. Flooding was assumed as a result of overtopping levees, not levee failure. Condition of levees was not considered.

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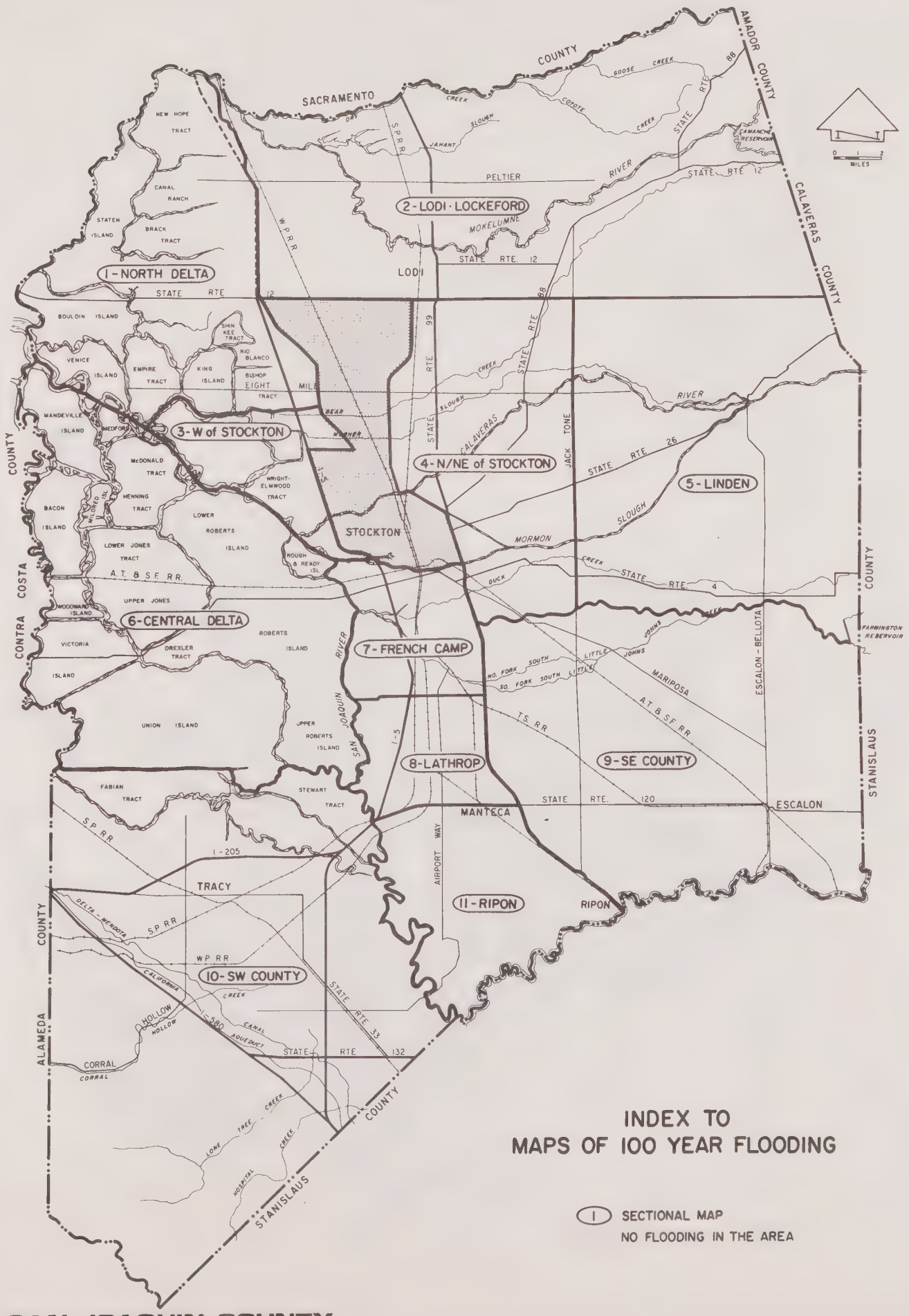
[1]These maps are available for review at the San Joaquin County Planning Department.

[2]The Flood Insurance Study(2) includes a summary of discharges for selected locations along the waterways in the County.



INDEX TO MAPS OF 100 YEAR FLOODING

(1) SECTIONAL MAP
NO FLOODING IN THE AREA

SAN JOAQUIN COUNTY

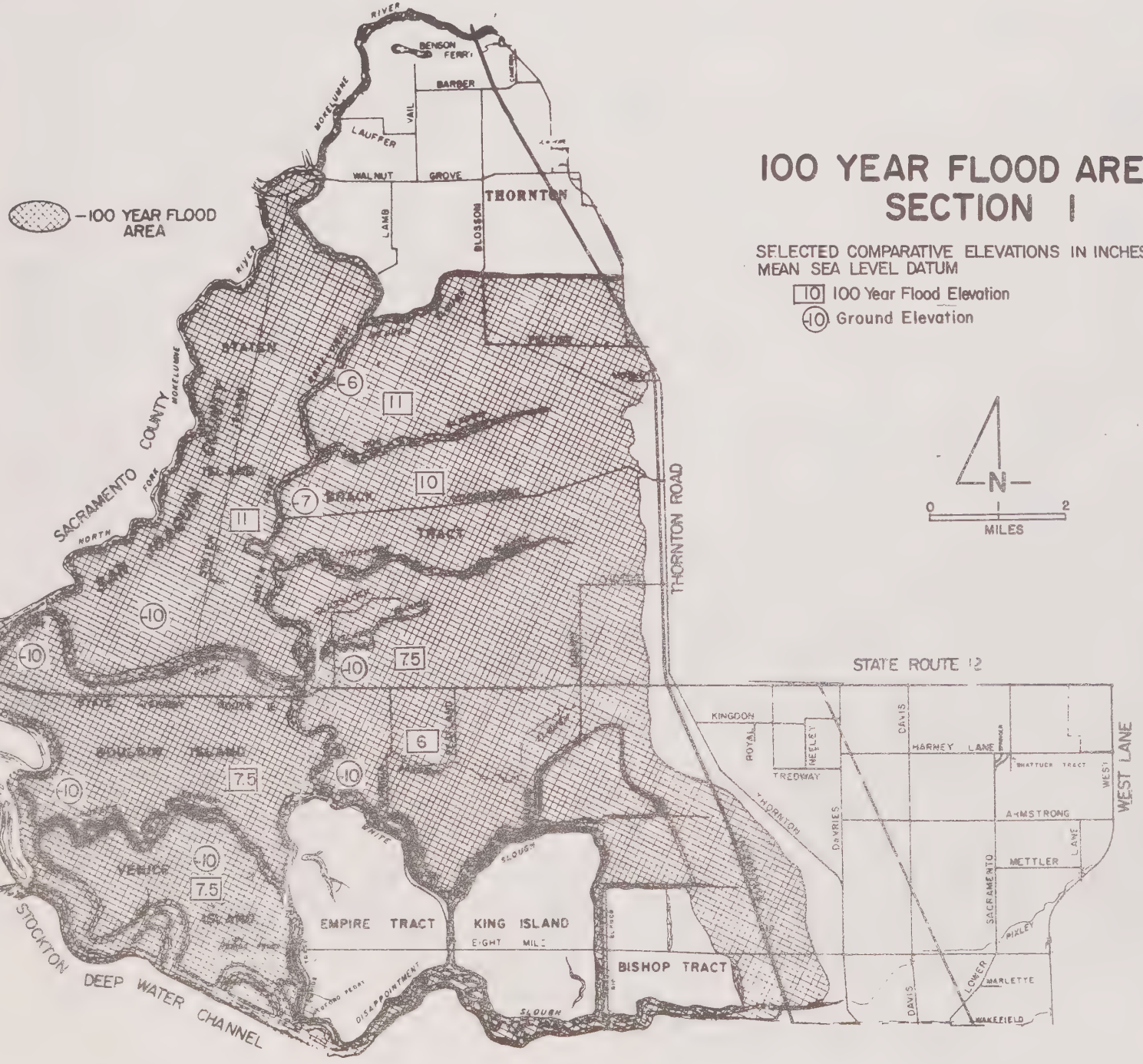
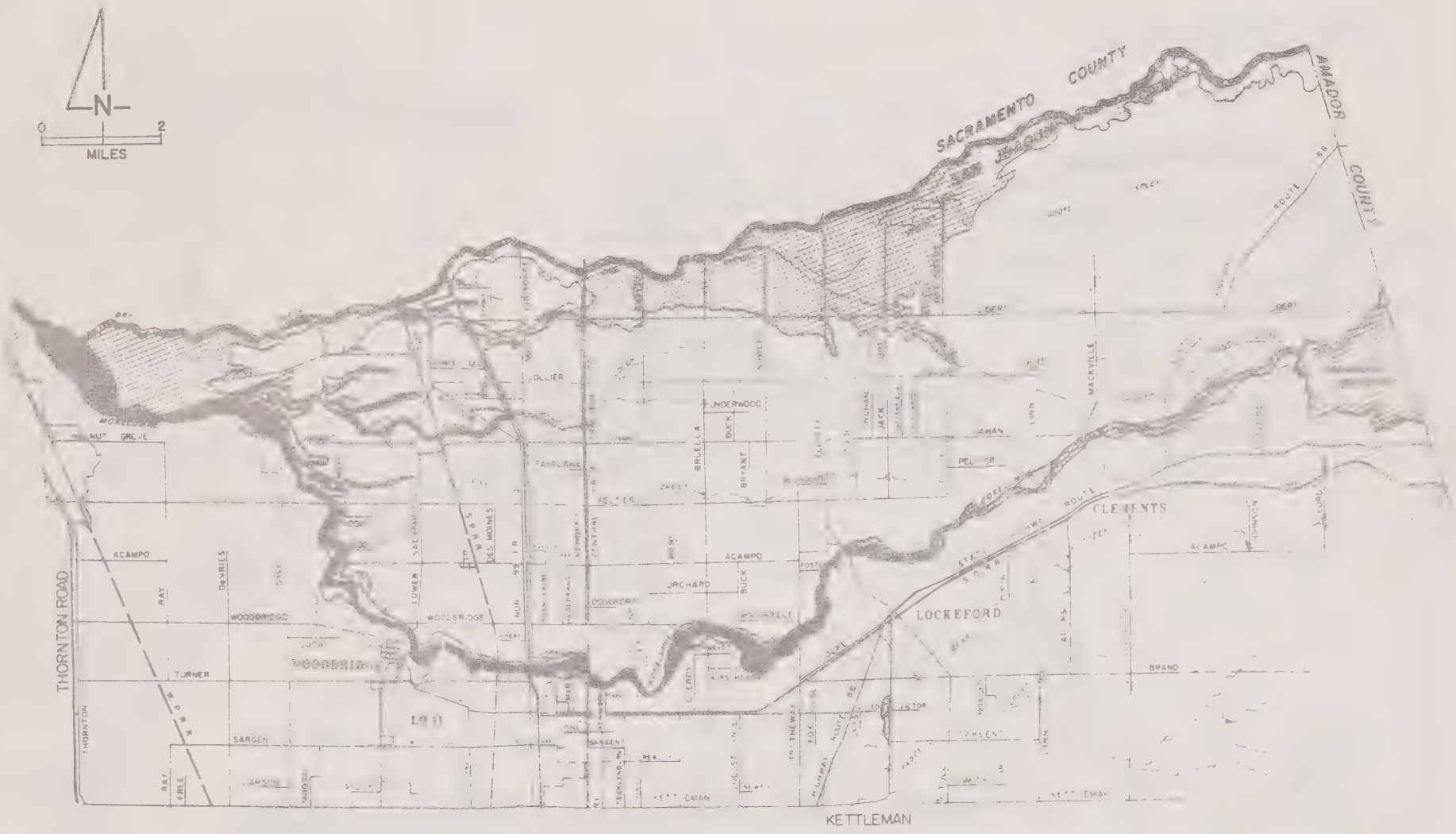


EXHIBIT III-5

SOURCE: FLOOD INSURANCE MAPS, 11/77



FLOODWAY

REMAINDER OF 100 YEAR FLOOD AREAS

100 YEAR FLOOD AREAS
SECTION 2

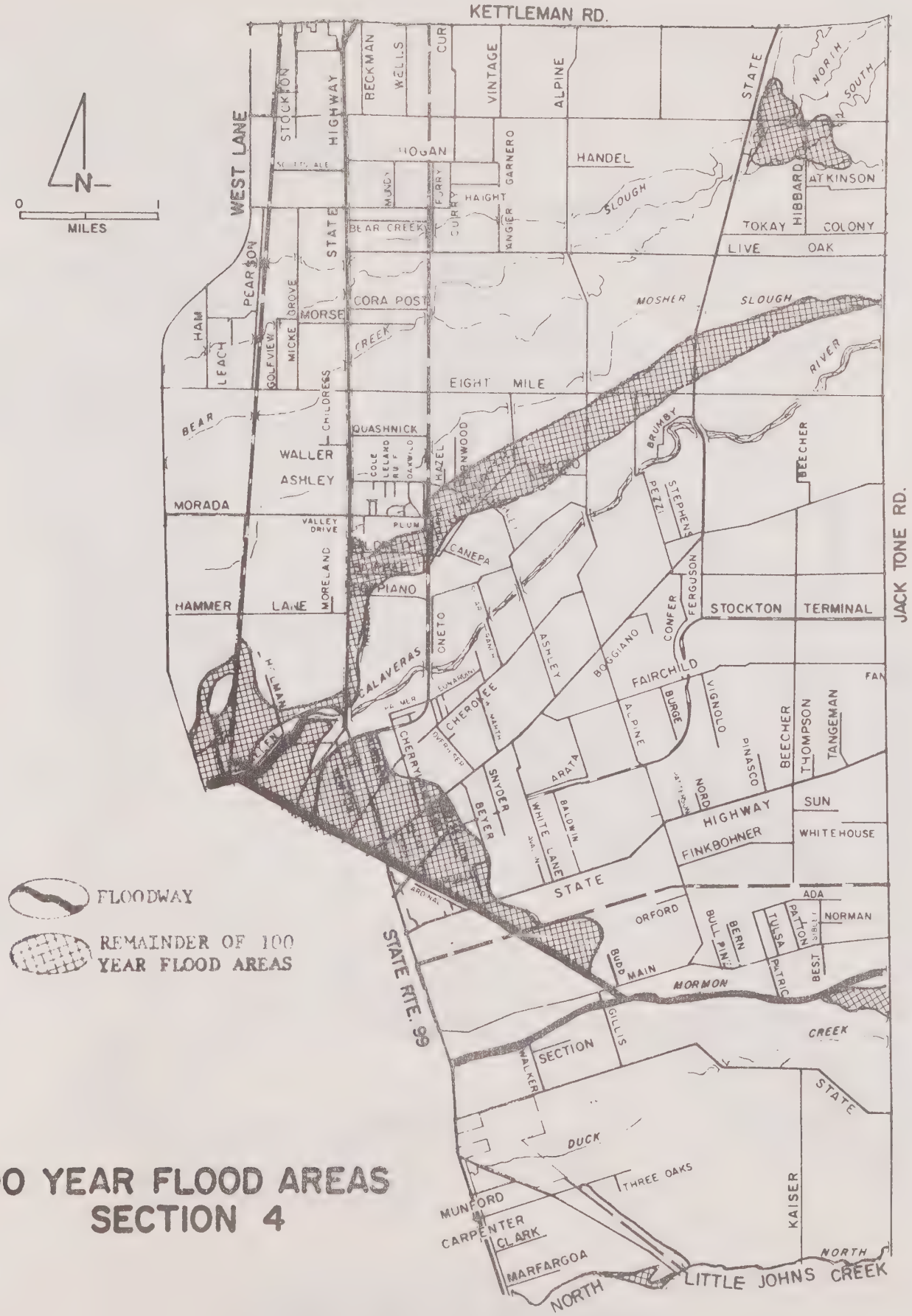
SOURCE: FLOOD INSURANCE MAPS, 11/77

100 YEAR FLOOD AREAS
SECTION 3

FLOODWAY

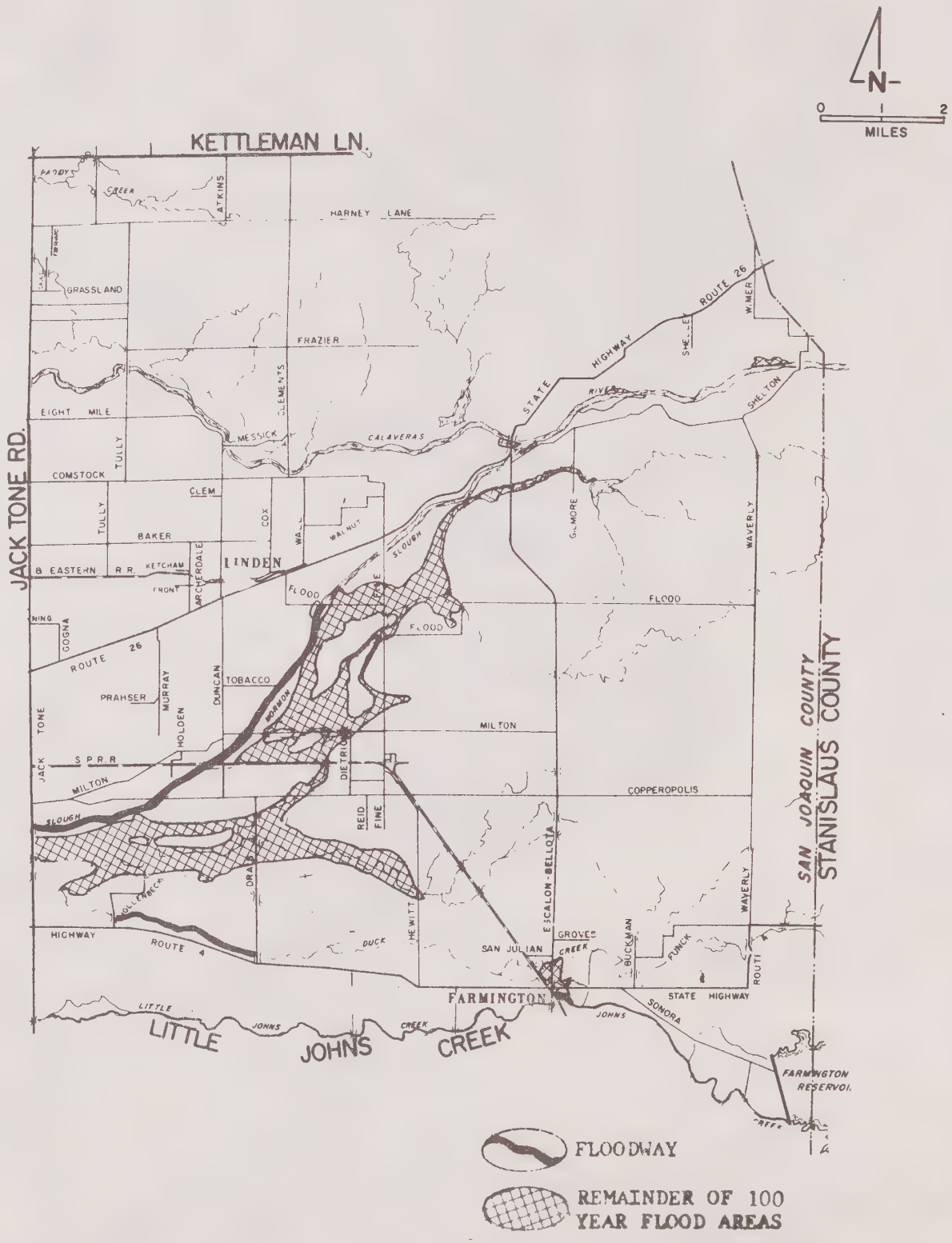
REMAINDER OF 100 YEAR FLOOD AREAS

SOURCE: FLOOD INSURANCE MAPS, 11/77



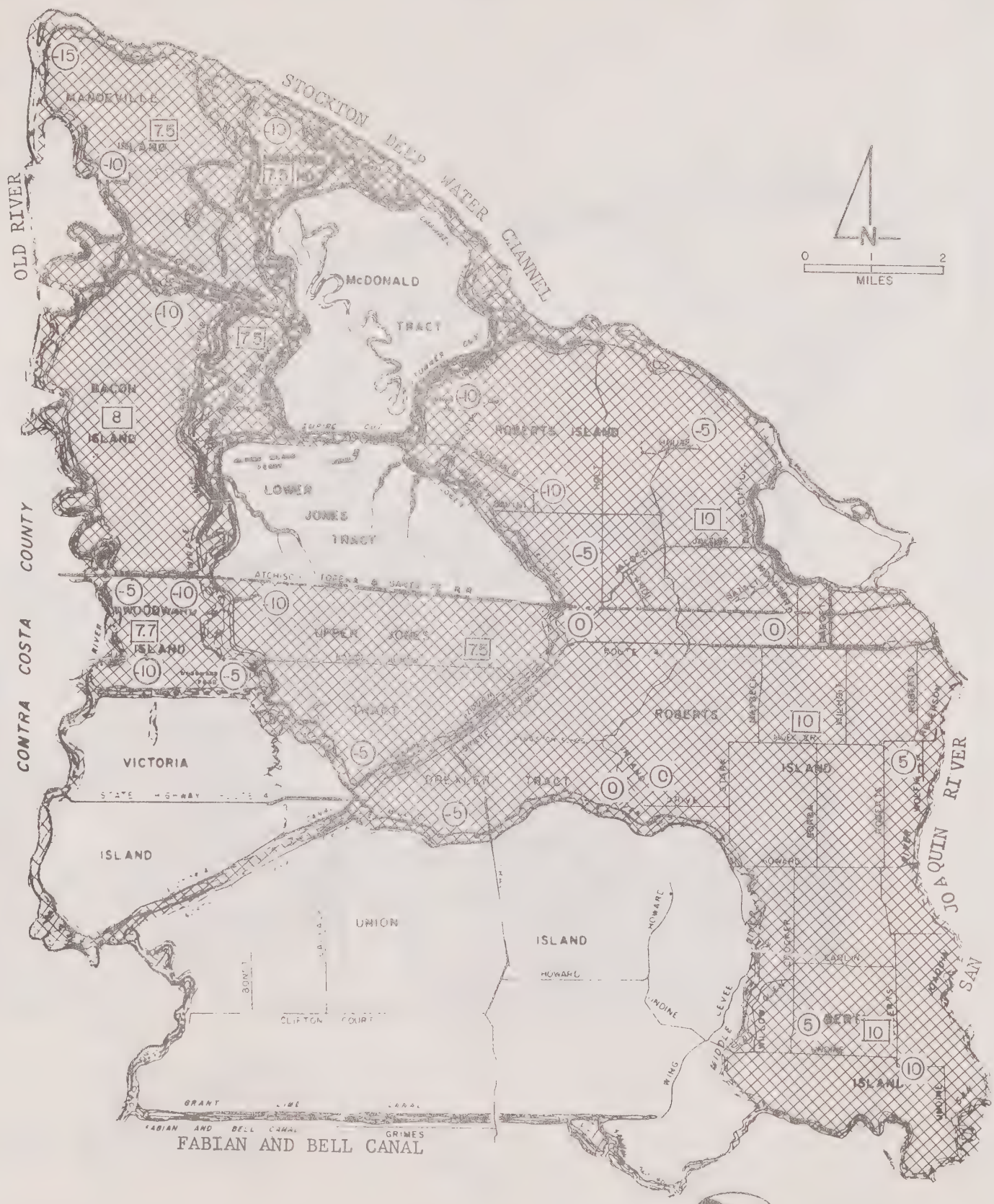
100 YEAR FLOOD AREAS
SECTION 4

SOURCE: FLOOD INSURANCE MAPS, 11/77



100 YEAR FLOOD AREAS
SECTION 5

SOURCE: FLOOD INSURANCE MAPS, 11/77



100 YEAR FLOOD AREAS
SECTION 6

SELECTIVE COMPARATIVE ELEVATIONS,
MEAN SEA LEVEL DATUM

[10] - 100 Year Flood Elevation

(10) - Ground Elevation

SOURCE: FLOOD INSURANCE MAPS, 11/77

100 YEAR FLOOD AREAS
SECTION 7

SOURCE: FLOOD INSURANCE MAPS, 11/77

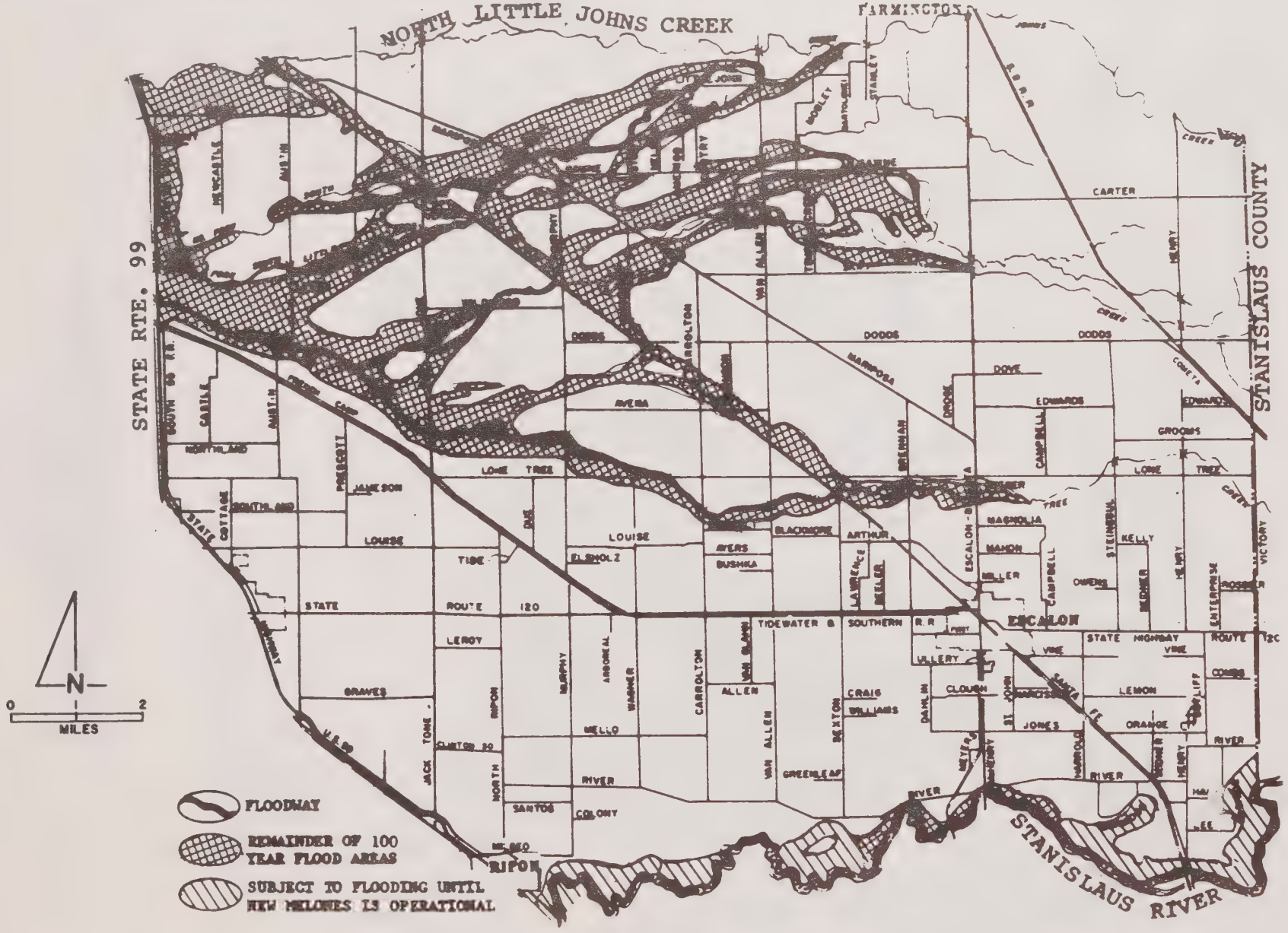
FLOODWAY

REMAINDER OF 100 YEAR FLOOD AREAS

SUBJECT TO FLOODING UNTIL NEW MELONES IS OPERATIONAL

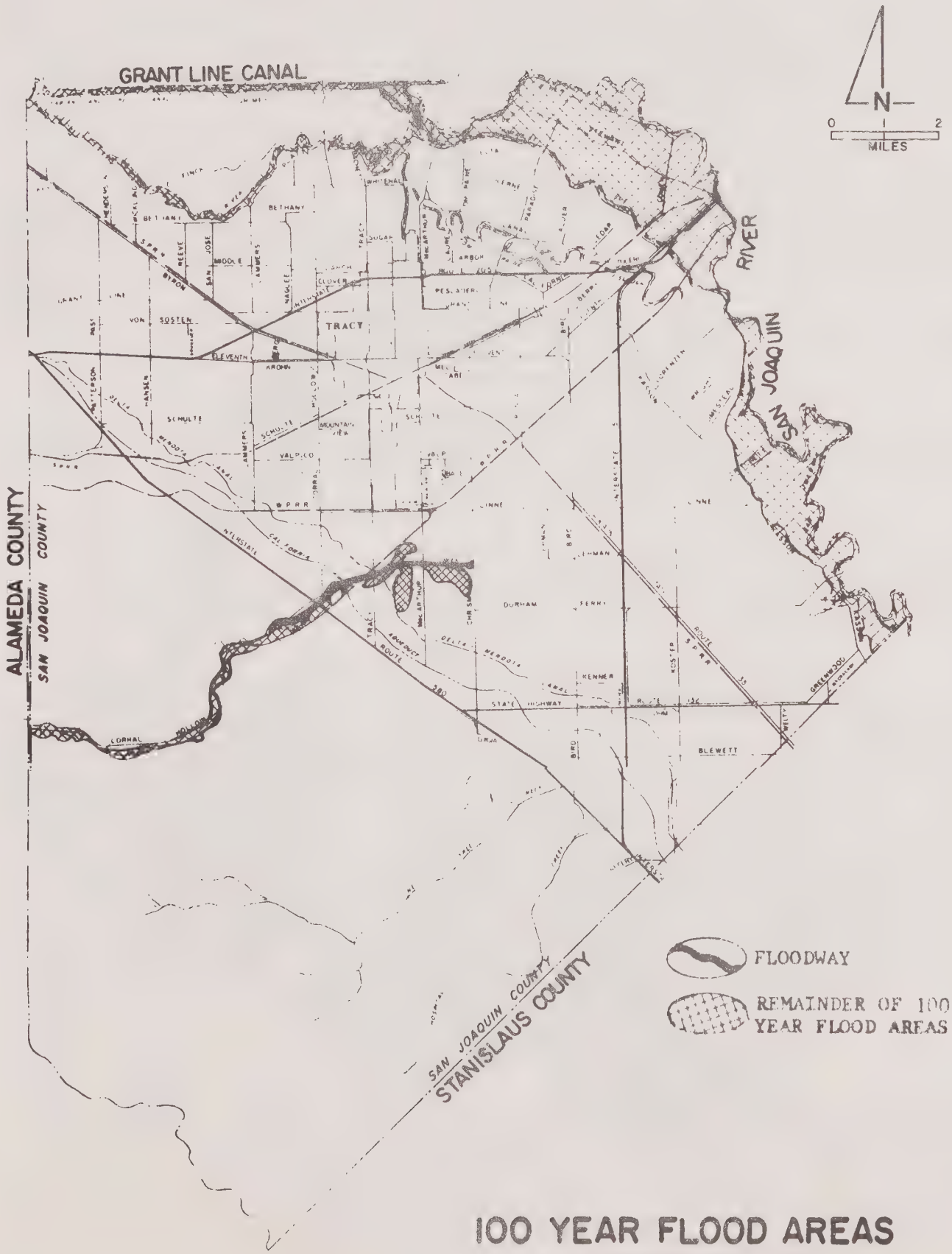
100 YEAR FLOOD AREAS SECTION 8

SOURCE: FLOOD INSURANCE MAPS, 11/77



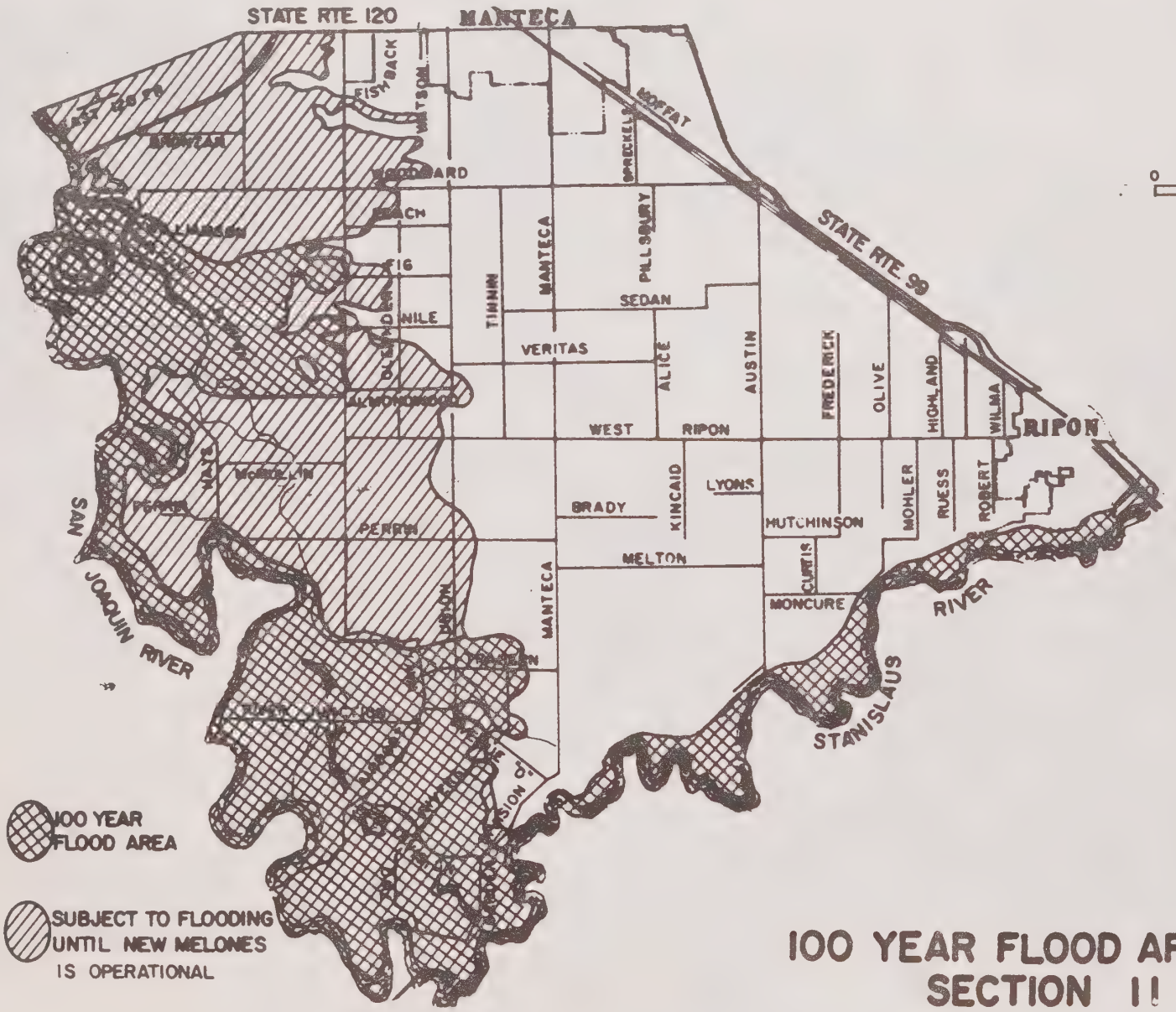
100 YEAR FLOOD AREAS
SECTION 9

SOURCE: FLOOD INSURANCE MAPS, 11/77



100 YEAR FLOOD AREAS
SECTION 10

SOURCE: FLOOD INSURANCE MAPS, 11/77



100 YEAR FLOOD AREAS SECTION II

SOURCE: FLOOD INSURANCE MAPS, 11/77

100 Year Flood Hazard Mitigation

Approximately 20% of San Joaquin County is subject to the 100 year flood(2). With such a widespread potential impact, a variety of flood management means become necessary. Exhibit III-16 indicates a series of actions in progress and proposed to minimize the effects of flooding in San Joaquin County.

National Flood Insurance Program

Since 1973, San Joaquin County has been participating in the National Flood Insurance Program. This program is part of a comprehensive approach by the Federal Government to reduce flood damage and to cope with the disasterous effects of floods. There are three major elements to the program as follows:

a. Identification of areas subject to flooding
b. Sale of insurance to isolate the cost to affected parties.
c. Flood Plain Management: requiring areas subject to the 100 year flood to receive special development regulation.

A comparison of benefits and requirement of participation versus non-participation is provided in Exhibit III-17. The major benefit of participation is that flood insurance is available only in participant communities.

Levee Failure Hazard

The prospect of levee failure in San Joaquin County is almost exclusively associated with the Delta. While levees exist in other portions of the county, the circumstances that contribute to potential of levee failure in the Delta are substantial.

In prehistoric times, the Delta was a vast, low-lying swamp-like area upstream from the confluence of the San Joaquin and Sacramento Rivers. It was interlaced by many streams and sloughs and largely covered by dense growths of tule and other marsh type vegetation. Reclamation of the Delta has occurred over the past 100 years, and islands of rich agricultural lands have been created with the construction of levees.

The Delta is affected by two water movements, stream outflow and tidal effect (2). Before dredging and levee projects altered the Delta, the effect of spring tides could submerge more than half the area and river floods could overflow the entire area, particularly when flood crests, high tide, and strong onshore winds occurred concurrently. Downstream flows to the Delta have been modified by construction of flood control projects; however, the concentration of many different streams in combined flow increases the magnitude of Delta waterflow and the variation in waterflow.

Characteristics of Delta Levees

Construction of Delta levees has occurred over the past one hundred years. From the beginning until recently, levees were constructed from the material closest at hand. In many cases this was peat and silt. Unconsolidated peats and stream deposited silts are of low density, low shear strength, and high moisture content. When dried out and exposed to air, peat soils oxidize, erode, and subside.[1] Consolidation of soft levee foundation material requires

[1]Subsidence, its causes and effects on Delta levees is discussed in Chapter II, Geologic Hazards. Probability of Delta levee stability failure is provided in Exhibit II-9.

EXHIBIT III-16

FLOOD MANAGEMENT PROGRAM FOR SAN JOAQUIN COUNTY

AREA OF ACTION	STATUS	ACTION
FLOOD PROTECTION SYSTEM	In progress	Continue existing programs of levee construction, improvement, and maintenance.
	In progress	Continue to support flood protection aspects of upstream reservoirs.
GENERAL PLAN	In progress	Use new flood information in the preparation of the County's Safety Element.
	Proposed	Reconsider areas planned for urban development which are subject to flooding.
ZONING ORDINANCE	In progress	Prepare and adopt a flood plain zoning ordinance.
	Proposed	Apply flood zones and regulations to areas subject to flood hazard.
SUBDIVISION ORDINANCE	In progress	Incorporate flood protection measures into the revision of the County Subdivision Ordinance.
BUILDING CODE	In progress	Incorporate flood protection measures into the County building code.
FUTURE DEVELOPMENT	In progress	Continue to review all land use proposals (use permits, development plans, excavation permits, parcel maps, subdivision maps) for flood hazard.
	Proposed	Continue to condition projects to require flood protection.
	Proposed	Require the delineation of floodways and the extent of 100-year flood plains on all maps.
EXISTING DEVELOPMENT	Proposed	Identify areas of existing urban development and public installations in need of flood protection.
	Proposed	Develop methods of protection appropriate to each area of hazard.
NATIONAL FLOOD INSURANCE PROGRAM	In progress	Continue County participation in the program.
	In progress	Provide flood information, as requested, to lending institutions and insurance agents
	In progress	Establish record-keeping and report procedures as required by the flood insurance regulations
PUBLIC INFORMATION	Proposed	Preparation of a brochure explaining flood hazards & flood management in San Joaquin County.
	Completed	Notify all property owners in the 100-year flood plain.
	Completed	Hold area meetings to inform the public of the flood hazard and of the County's Flood Management Program.
EMERGENCY PREPAREDNESS	In progress	Prepare an emergency services plan for dealing with flooding from a 100-year flood. Include determination of mass care centers, evacuation routes, and issuance of flood warnings, etc.

COMPARISON OF PARTICIPATION VS. NON PARTICIPATION IN FLOOD PROGRAM

	CONSIDERATION	AREA	PARTICIPATING COMMUNITY	NON PARTICIPATING COMMUNITY
REAL ESTATE LOANS	Availability of federal financial assistance (FmHA, FHA, SBA, VA) Subject to requirements	Flood Hazard Areas	Available. Must purchase flood insurance	Not available
		Non flood County Areas	Available	Available
	Availability of conventional (FDIC) Mortgages	Flood Hazard Areas	Available Must purchase flood insurance	Loans at discretion of lender. Must disclose flood hazard and lack of disaster loan availability
		Non Flood County Areas	Available. Flood insurance optional	Available
DISASTER RELIEF	Availability of Flood Disaster Loans	Flood Hazard Area	Available. Must purchase flood insurance	Not available
		Non Flood County Area	Available. Flood insurance may be needed	Not available
	Availability of other Disaster Loans	Flood Hazard Area	Available. New insurance purchase condition	Available. No insurance necessary
		Non Flood Hazard Area	Not affected by flood regulations	Not affected by flood regulations
	Availability of Federal Disaster Acquisition (Not funded to date)	Flood Hazard Area	Available	Not available
		Non Flood County Areas	Available subject to appropriate provisions	Not available
	Emergency Disaster Relief (eg. temporary housing)	Flood Hazard Area	Available	Not available by law but in practice relief will be given
		Non Flood Hazard Area	Available	
FLOOD INSURANCE	Availability of Insurance for Existing Structures	Flood Hazard Area	Available	Not available, if community drops out, existing policies expire
		Non Flood County Area	Available	Not available
	Availablility of Insurance for New Construction Loans	Flood Hazard Area	Available	Not available
		Non Flood County Area	Available	Not available
	Requirement of Insurance for Federally Assisted New Construction Loans	Flood Hazard Area	Required	Financing not permitted
		Non Flood County Area	Not required	Not affected
	Requirement of Insurance for Conventional New Construction Loans	Flood Hazard Areas	Required	Not required. Lender must disclose flood hazard & lack of disaster loan availability
		Non Flood County Area	Not required	Not required
GRANTS	All Direct Federal Grants (i.e., public works, EPA)	Flood Hazard Area	Made subject to local reg. & insurance	Not permitted
		Non Flood County Area	Not affected	Not affected
ORDINANCES	Official Designation of Areas Subject to Flood	Flood Hazard Area	Requirement to designate floodway and flood fringe areas	Any requirements at local initiative
	Regulation of Construction Standards	Flood Hazard Area	Regulations for Floodway & Flood fringe	Any requirements at local initiative
		Non Flood County Area	Any requirement at local initiative	Any requirement at local initiative

Sources of Information:

Housing and Urban Development Act of 1968
Housing and Urban Development Act of 1969
Flood Disaster Protection Act of 1973
Housing and Community Development Act 1977
Federal Register 10/26/76

San Joaquin County Planning Department 3/78

periodic dredging to keep pace with levee settlement. Explorations on the alignment of certain levees show that the foundation peat at certain locations has consolidated to approximately 60 percent of its original thickness, but with only limited gain in shear strength. In the same locations approximately half of the fill material in the present levee section is below the original ground level(9).

All levees are not constructed from peat and silt, the comparative strength of levees is, therefore, inconsistent and depends on how and when the levee was constructed, who constructed it, what the relative wear-and-tear has been and how well that levee has been maintained.

An evaluation of Delta levees has been published in the Department of Water Resources Bulletin #192(10).

Conditions Which Can Cause Levee Failure

Levees must withstand many forces. Levees are continually being eroded by stream outflow, tidal flow and wave wash from winds and boat wake. As tracts subside, water pressure in adjoining channels may become too great for levees to withstand lateral pressure. A flood which may not overtop levees may cause sufficient seepage and weakening of the levee to cause the levee failure. Exhibit III-18 provides two illustrations: a)a levee which is improperly assigned and b)a properly designed levee.

Chapter II discusses the geologic hazards associated with levees. These hazards are real and, although unpredictable, can be expected to someday lead to levee failure and subsequent flooding.

Extent of Areas Subject to Levee Failure

Because of unstable foundation conditions and past construction and maintenance practices, many miles of Delta levees are inadequate to protect the islands from inundation and preserve the Delta channel configuration essentially as it is today. If the levees are not improved, the frequency of flooding will increase in the future.

At present, public information concerning the full potential for levee failure is out-of-date and unreliable. Exhibit III-19 provides areas of levee deterioration prepared by the U.S. Army Corps of Engineers in May 1966. Since that time improvements to Delta levees have occurred. Additional studies are necessary to determine the extent of the hazard.

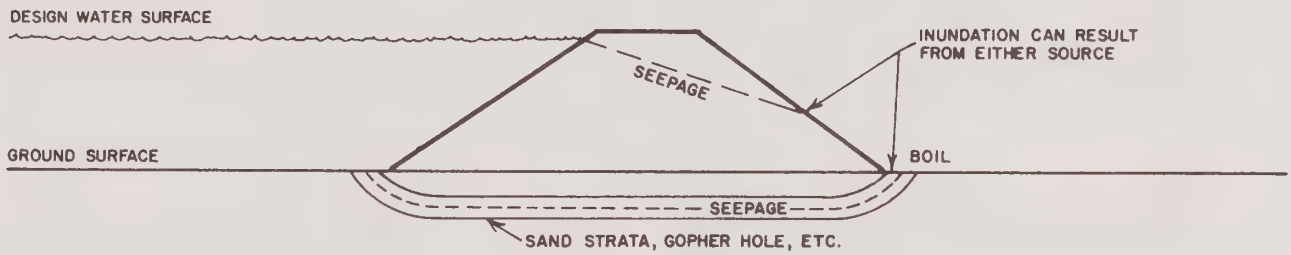
A 100 year flood in the Delta inevitably would cause levee failure and flooding in addition to that resulting from overtopping of the levees built to less than 100 year standards.

Effects of Levee Failure

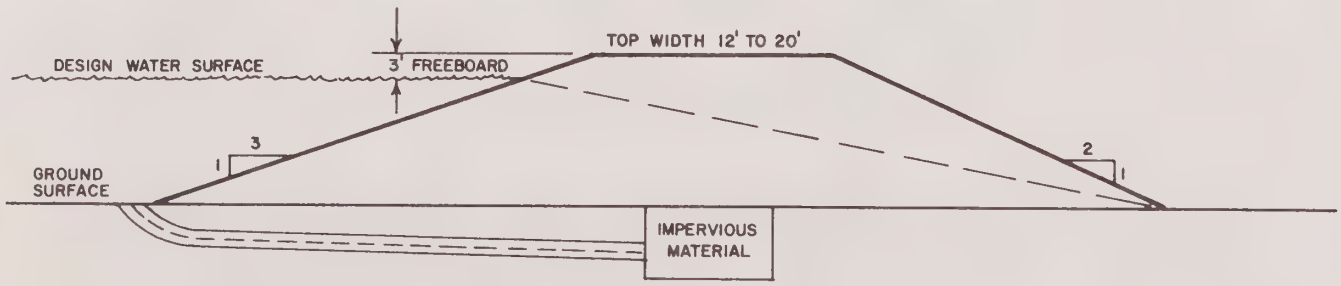
The characteristics of inundation will depend upon existing conditions. The elevation of the Delta islands vary. The greater the difference between the elevation of the watercourse and the island, the greater the height and velocity of flooding. A breach in a levee under non-flood conditions would be localized to the specific tract. One hundred year flood conditions could precipitate a series of levee failures.

If a levee fails on any tract, all of the structures on that tract will be susceptible to destruction, all crops are likely to be inundated and a variety of other dangers are likely.

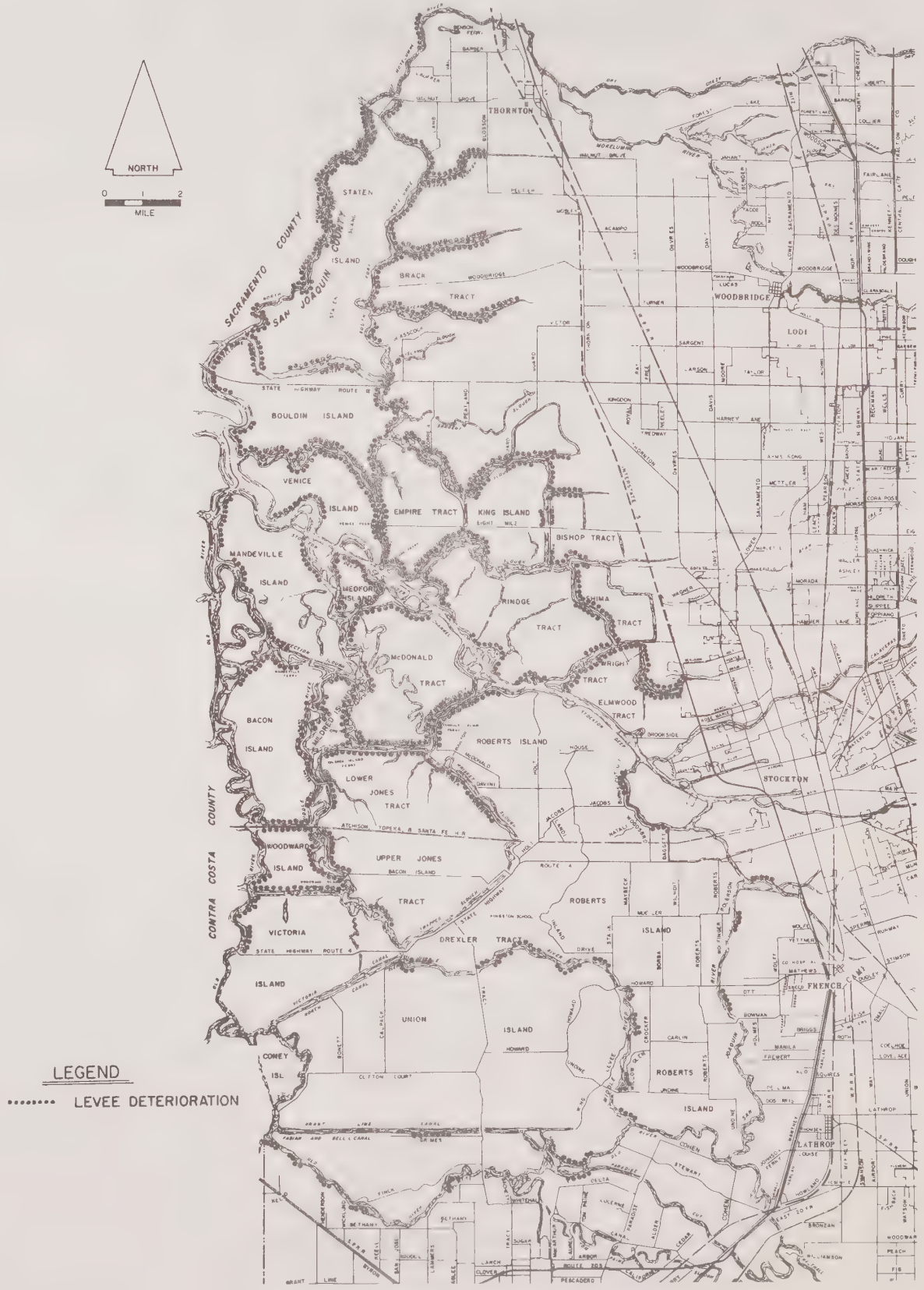
LEVEE DESIGN AND SEEPAGE POTENTIAL



IMPROPER DESIGN



PROPER DESIGN



AREAS OF DELTA LEVEE DETERIORATION

SOURCE: U.S. ARMY CORPS OF ENGINEERS BROCHURE MAY 1966

Flooding due to collapse of levees will be compounded in destructive effects by the lack of adequate evacuation and rescue routes, since levees are used for roads and provide the only access roads in many cases. Some tracts are islands where land escape routes may be impossible.

Because of the high cost and difficulty of repairing levee breaks, protecting the insides of the flooded islands from wavewash, and pumping out the floodwater, each inundated area which is not declared a disaster area with associated federal and state financial assistance could remain permanently flooded. There will be a continuing and increasing demand for public funds for emergency repairs to levees which fail.

If islands are permanently flooded, greater amounts of fresh water would be lost by evaporation from the flooded areas than from vegetated areas. As islands flood and levees are eroded away, the adjacent islands are in danger from increased windwave erosion. The present configuration of Delta channels and islands could become an inland sea with resultant losses in recreational use.

Levee failure is a significant and substantial hazard to the safety and well-being of San Joaquin County residents. Under a given set of circumstances it is conceivable that any tract in the Delta could be subject to flooding. Exhibit III-20 identifies Delta tracts previously flooded due to levee failure.

Levee Failure Hazard Mitigation

There is widespread public interest in ensuring that Delta islands, channels, and levees continue to be available for farming, recreation, transportation corridors, wildlife habitat, and natural gas extraction.

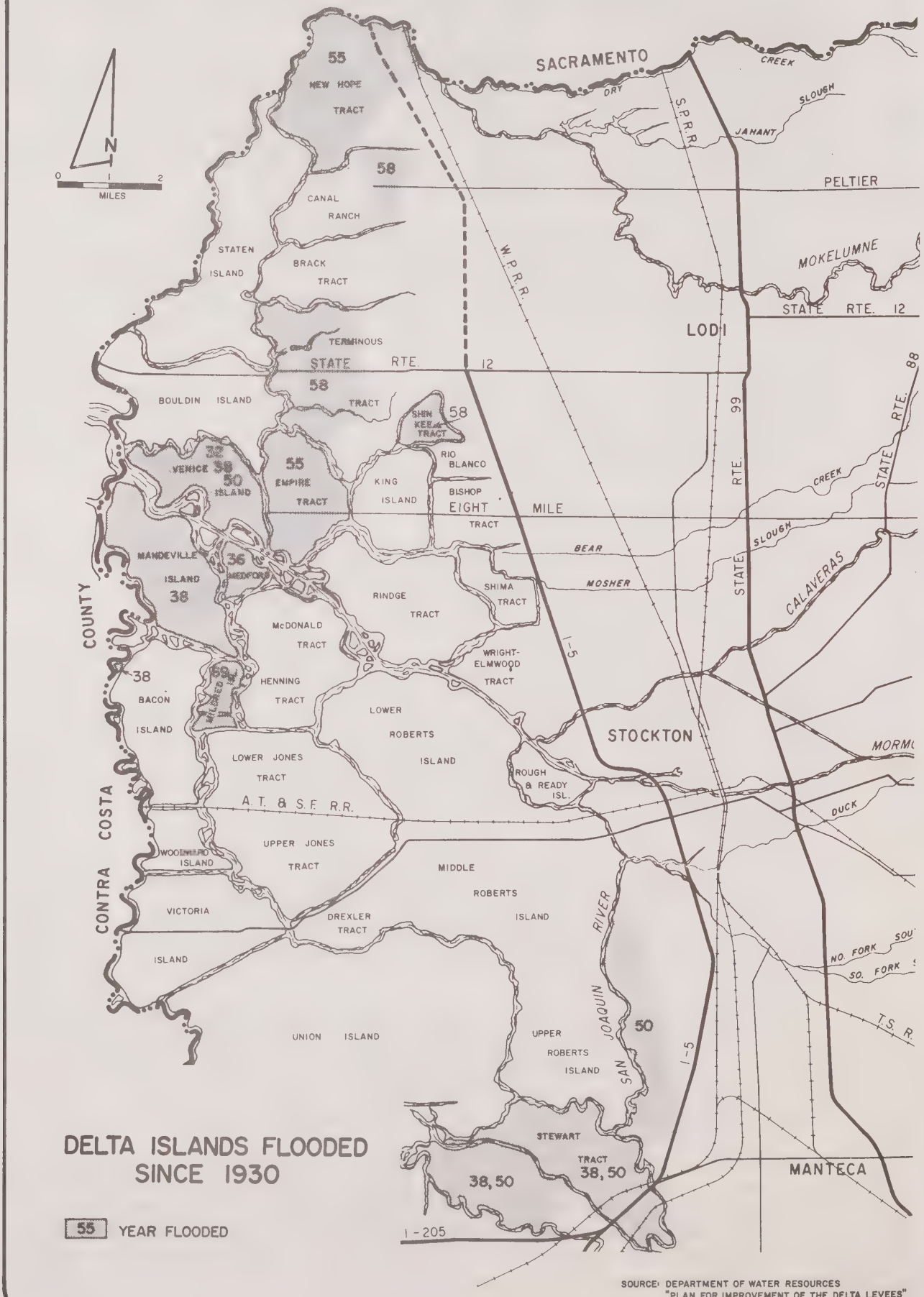
To minimize the risk associated with levee failure it will be necessary to complete a thorough analysis of levee stability in the Delta to determine the potential risk of levee failure for each tract. Such a study has been undertaken by the Army Corps of Engineers to be completed in 1980(18). Information compiled by the Corps of Engineers includes a series of 72 levee cross-sections taken by the Department of Water Resources. Preliminary data from the Corps of Engineers study is to be available shortly. The Department of Water Resources is also continuing its levee investigations and working with the Corps (20).

Construction and maintenance of private levees is under the authority of private owners and reclamation districts. Consequently, repairs and maintenance of levees follow no uniform standards. Standards for inspection and maintenance and local flood control district-inspections would enable uniform development of levees.

Local, State and Federal participation in reconstruction of levees is proposed by Water Resources Bulletin #192(10). This action is awaiting completion of the Corps of Engineers study. No solution will be final, however, since waves will continue to erode levees and subsidence of the islands will continue to increase pressure on levees.

A reasonable degree of flood protection can be developed by rebuilding and strengthening existing levees with a staged construction period of 20 years. Significant recreation benefits can be achieved by incorporating special recreation facilities. Alternative designs, including recommendations by local districts and the counties concerning the extent of participation and

EXHIBIT III-20



DELTA ISLANDS FLOODED SINCE 1930

55 YEAR FLOODED

SOURCE: DEPARTMENT OF WATER RESOURCES
"PLAN FOR IMPROVEMENT OF THE DELTA LEVEES"
MAY 1975

recreational facilities, can be adopted to reflect local views regarding accessibility by land or water and regarding the degree of flood protection desired. Additional planning studies and an environmental impact report would be required prior to construction.

The cost of improving the levee system can be economically justified by the flood damage reduction, land enhancement, levee erosion reduction, water quality, transportation, and recreation benefits. However, before a large amount of public funds are invested in the Delta, the implications of subsidence on the future of the islands must be explored further. (see pages II-17 to II-23).

Aside from levee improvement, protection from levee failure would include 1)restricting boating speeds as suggested by the Waterways Use Program of the Delta Master Recreation Plan (11), 2)limiting removal of vegetation which serves to anchor levee soils (14), and 3)adherence to agricultural practices which minimize subsidence (Exhibit II-10).

Localized Drainage Hazards

Many areas in the county are covered with heavy clay soils or are subject to hardpan layers near the surface. These areas may also be level and developed without drainage provisions. During heavy rainfall, water in low lying level areas where surface drainage is poor or impaired can pond to a depth of from one (1) to three (3) feet.

Damage to crops and other property often occurs, particularly in a wet year in which water may stand on the ground for weeks at a time. Hazards to life from standing water are low. These are health hazards, and standing water could lead to well contamination and septic tank failure.

Older small wells not affected by recent Health District regulations may be in "pits" or be without pedestals facilitating contamination. Standing water saturates the soil and will soak each field, causing surface and lateral movement of ineffectively treated waste.

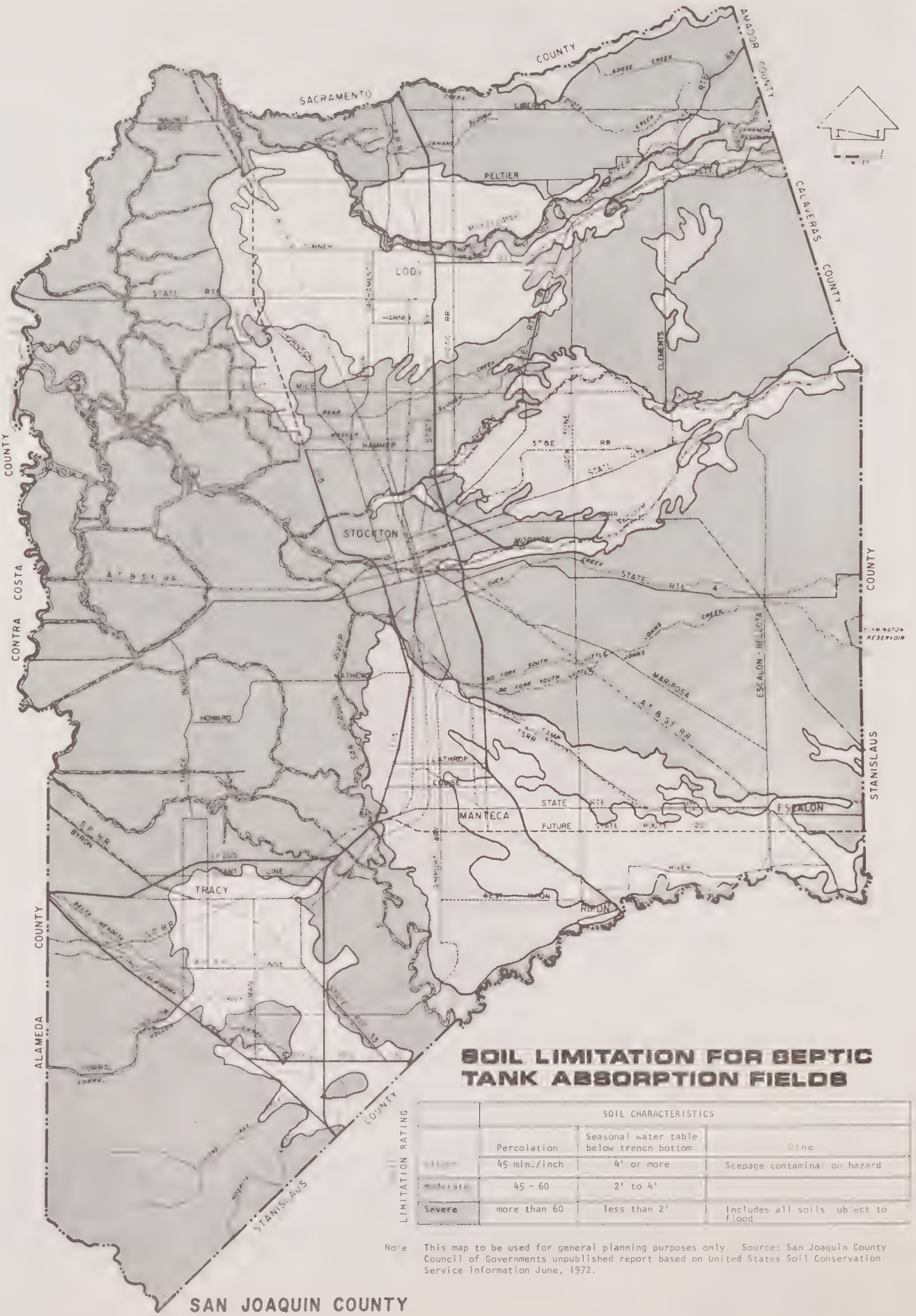
Standing water can also cause damage to or hazard from electrical circuits, telephone lines, roads and structural foundations. Exhibit III-21 provides a map of soil limitations for use of septic tanks in San Joaquin County. This indicates areas where standing water problems are most likely.

Localized Drainage Hazard Mitigation

There are existing County ordinances that regulate drainage.

1. Natural and approved man made drainage channels are protected.
2. Commercial and industrial development must provide for storm drainage and on site retention.
3. Subdivisions must provide adequate drainage for streets and parcels.
4. Public road drainage is protected.

Storm drainage systems exist in the incorporated cities and the unincorporated communities of Linden, Victor, Lockeford, and Lathrop. These systems could be expanded to accommodate additional urban development. In rural areas storm drainage varies greatly due to the soils, the agricultural earth movement which has occurred, the topographical contours, and the sophistication of



SOIL LIMITATION FOR SEPTIC TANK ABSORPTION FIELDS

LIMITATION RATING	SOIL CHARACTERISTICS		
	Percolation	Seasonal water table below trench bottom	Other
[illegible]	45 min./inch	4' or more	Seepage contamination hazard
[illegible]	45 - 60	2' to 4'	
Severe	more than 60	less than 2'	Includes all soils subject to flood

Note This map to be used for general planning purposes only. Source: San Joaquin County Council of Governments unpublished report based on United States Soil Conservation Service information June, 1972.

SAN JOAQUIN COUNTY PLANNING DEPARTMENT

property owners in integrating drainage requirements into project site plans. In a heavy rainfall year, many homes and other structures in rural areas are flooded due to inadequate elevation of the foundation or poor on-site location. Additional regulation of foundation height and/or site location of structures will partly mitigate localized drainage problems.

Dam Failure Flood Hazard

Few threats to health and safety assume the massive proportions envisioned with a dam failure. The thought of a 50 foot wall of water traveling at devastating speed adopts nightmarish proportions. Despite the number of dams near San Joaquin County, the risk of dam failure inundating portions of San Joaquin County is considered very low, though the degree and nature of risk for each dam is unknown. A dam failure can occur under three general conditions: as the result of an earthquake, as an isolated incident due to structural instability, or in time of heavy rain in excess of design capacity. Exhibit III-22 provides a summary of general effects that can be anticipated if special dams were to fail. Exhibits III-23 to III-29 indicate the areas subject to inundation in event of dam failure.

Dam Failure Risk Mitigation

In August, 1972, the Governor approved Senate Bill 896, an Act to add Section 8589.5 to the Government Code relating to dam safety. The amended Dam Safety Act now requires that dam owners submit inundation maps to the California Office of Emergency Services for those dams whose total failure would cause loss of life or personal injury. This Act also requires local jurisdictions to adopt emergency procedures for the evacuation and control of populated areas below such dams.

The local office of Emergency Services has prepared a Dam Failure Plan. This plan includes a description of dams, direction of flood waters, responsibilities and actions of individual jurisdictions, and evacuation plans (12).

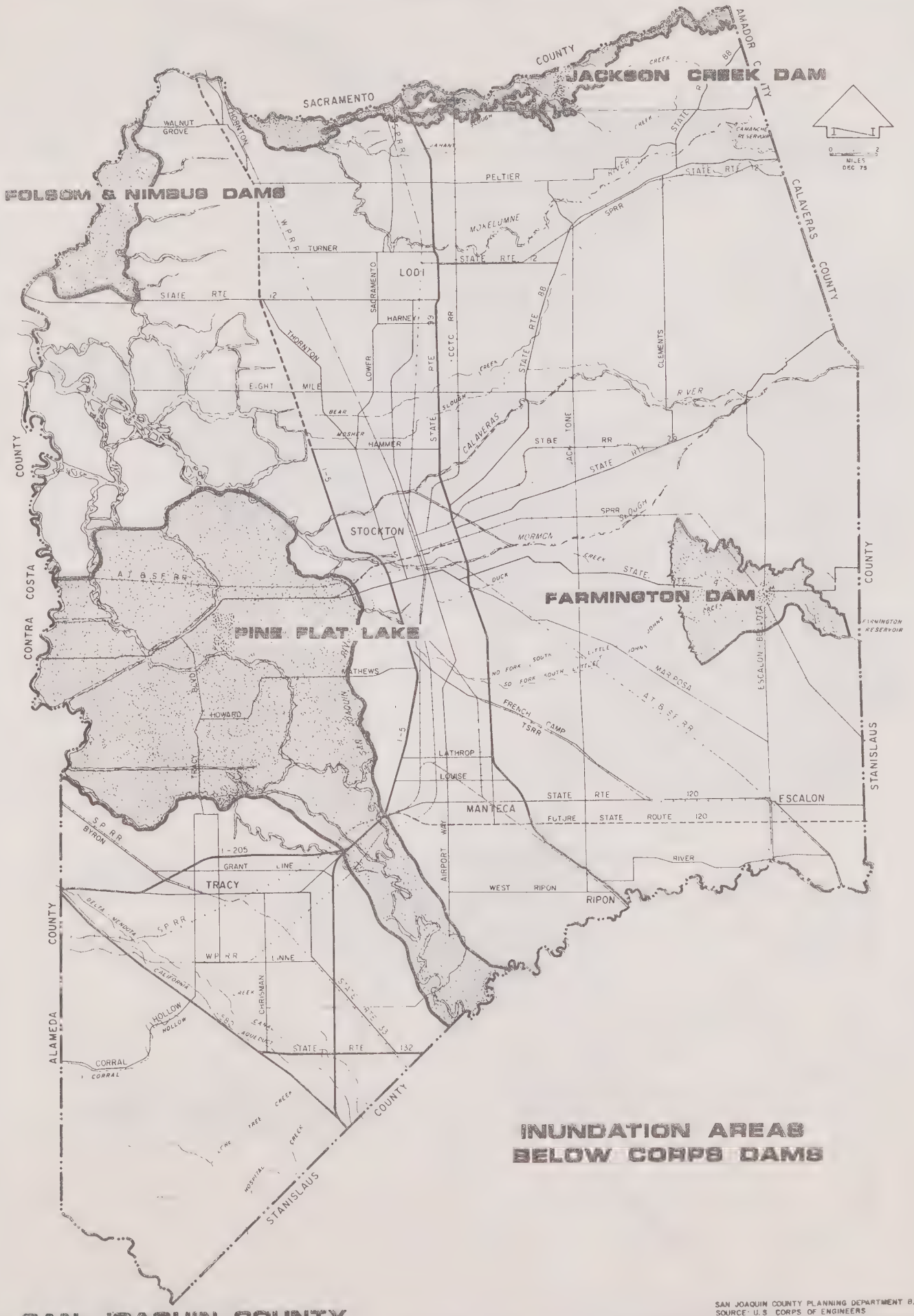
A study to determine the level of risk of each dam failure should be conducted by the state and/or federal government and made available to the public.

EXHIBIT III-22

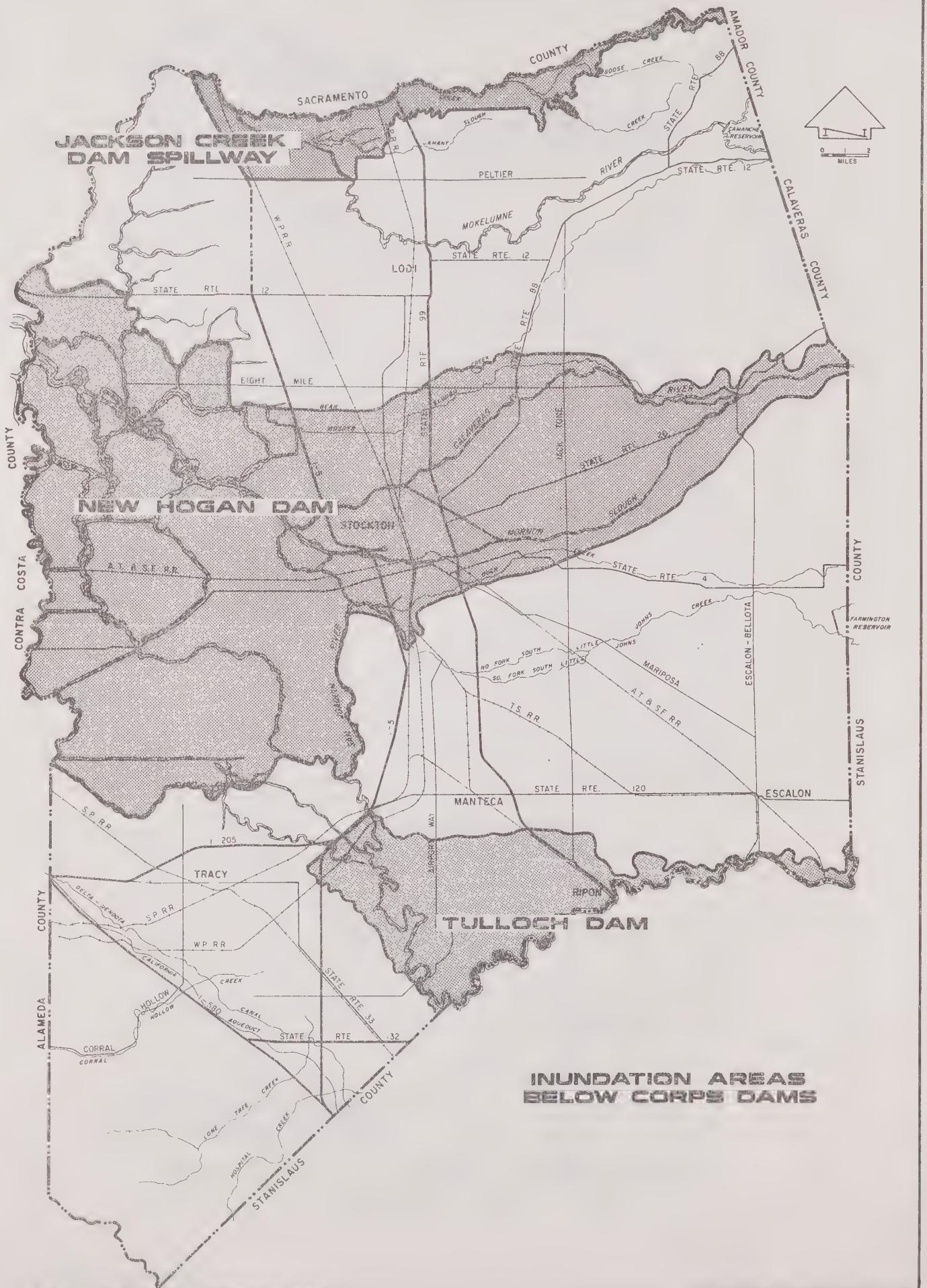
DAM FAILURE SUMMARY TABLE

	NEW HOGAN	CAMANCHE	CAMANCHE SOUTH DIKE	CAMANCHE NORTH DIKE	TULLOCH	JACKSON CREEK	JACKSON CREEK SPILLWAY	FARMINGTON	PINE FLAT LAKE	FOLSOM & NIMBUS	NEW MELONES	PARDEE	SAN LUIS
Map#	Map III-24	Map III-25	Map III-26	Map III-27	Map III-24	Map III-23	Map III-24	Map III-23	Map III-23	Map III-23	Map III-28	Map III-29	Map III-27
Location, County	Calaveras	San Joaquin	San Joaquin	Calaveras	Calaveras	Amador	Amador	San Joaquin	Fresno	Sacra-mento	Calaveras Tuolumne	Amador	Merced
Watercourse	Calaveras River	Mokelumne River	Mokelumne River	Mokelumne River	Stanislaus River	Jackson Creek	Jackson Creek	Little John's Creek	King River	American River	Stanislaus River	Mokelumne River	San Joaquin
Dam Type	Earth & Rock Fill	Earth & Rock Fill	Earth & Rock Fill	Earth & Rock Fill	Concrete Gravity	Earth & Rock Fill	Earth & Rock Fill	Earth Fill	Concrete Gravity	Gravel Fill	Rock Fill	Gravel	Earth Fill
Acre Feet	325,000	431,500	230,978	200,522	68,400	22,000	46,894	52,000	1,000,000	F. 1,010,000 N. 8,760	2,400,000	210,000	2,040,500
Owner	Corps of Eng.	East Bay M.U.D.	East Bay M.U.D.	East Bay M.U.D.	Oakdale-S.J. Irr. D.	Jackson V. Irr. D.	East Bay M.U.D.	Corps of Engineers	Corps of Engineers	Bureau of Recla.	Bureau of Recla.	East Bay M.U.D.	Bureau of Recla.
Est. Persons Threatened	176,000	210,600	99,800	36,200	7,400	400	1,225	500	3,660	40	65,300	63,600	3,660
Area Affected	Linden	Clements	Clements	Clements Bridge/Hwy 88	Murphy Rd.	Overflows Dry Creek	Overflows Dry Creek	Escalon-Ballota Rd.	Co. Line & S.J. River	N.W. Co. Area	Van Allen W. of Esc.	Clements	South Manteca
Time	1hr 45m	36 min	1 hr	1hr 10 min	9 hrs	1hr 40 m	1hr 40 m	30 min	110 hrs	18 hrs	5 hrs	1hr 10 m	34 hr.
Depth	12 ft	31 ft	50 ft	25 ft	25 ft			4 ft			18 ft	40 ft	
Velocity	5ft/sec	7ft/sec	6ft/sec	6ft/sec	3ft/sec			3ft/sec			7 ft/sec	6 ft/sec	
Area Affected	E. Stkn.	Lockeford	Lockeford	Bruella Rd.	Ripon	Elliott Rd.	Elliott Rd.		I-5		Lathrop	Lockeford	Lathrop
Time	3hrs	1hr 40m	2 hrs	4hrs 30 m	10hr 16 m	7hrs 30 m	5 hrs		120 hrs		15 hrs	2hr 35 m	42 hr.
Depth	5 ft	44 ft	37 ft	2 ft	24 ft						11 ft	16ft	
Velocity	2.5ft/sec	5ft/sec	4.5ft/sec	5ft/sec	3ft						5ft/sec	3 ft/sec	
Area Affected	Stockton	E. Lodi & E. Stkn.	W. Lodi & W. Stkn.	S.P. RR	West Ripon	Mokelumne River	W.P. RR				South Stkn.	Lodi	Van Buskirk
Time	5 hrs	4hrs 20 m	10 hrs	7hrs 50 m	11hr 40 m	13 hrs	10hr 30m				20hrs	6hr 30m	54 hrs.
Depth	5-10-15ft	25 ft	15 ft	7 ft	21 ft						0-7 ft	14 ft	
Velocity	Near 0	2ft/sec	1ft/sec	1ft/sec	2.5 ft/sec						0-5ft/sec	1 ft/sec	

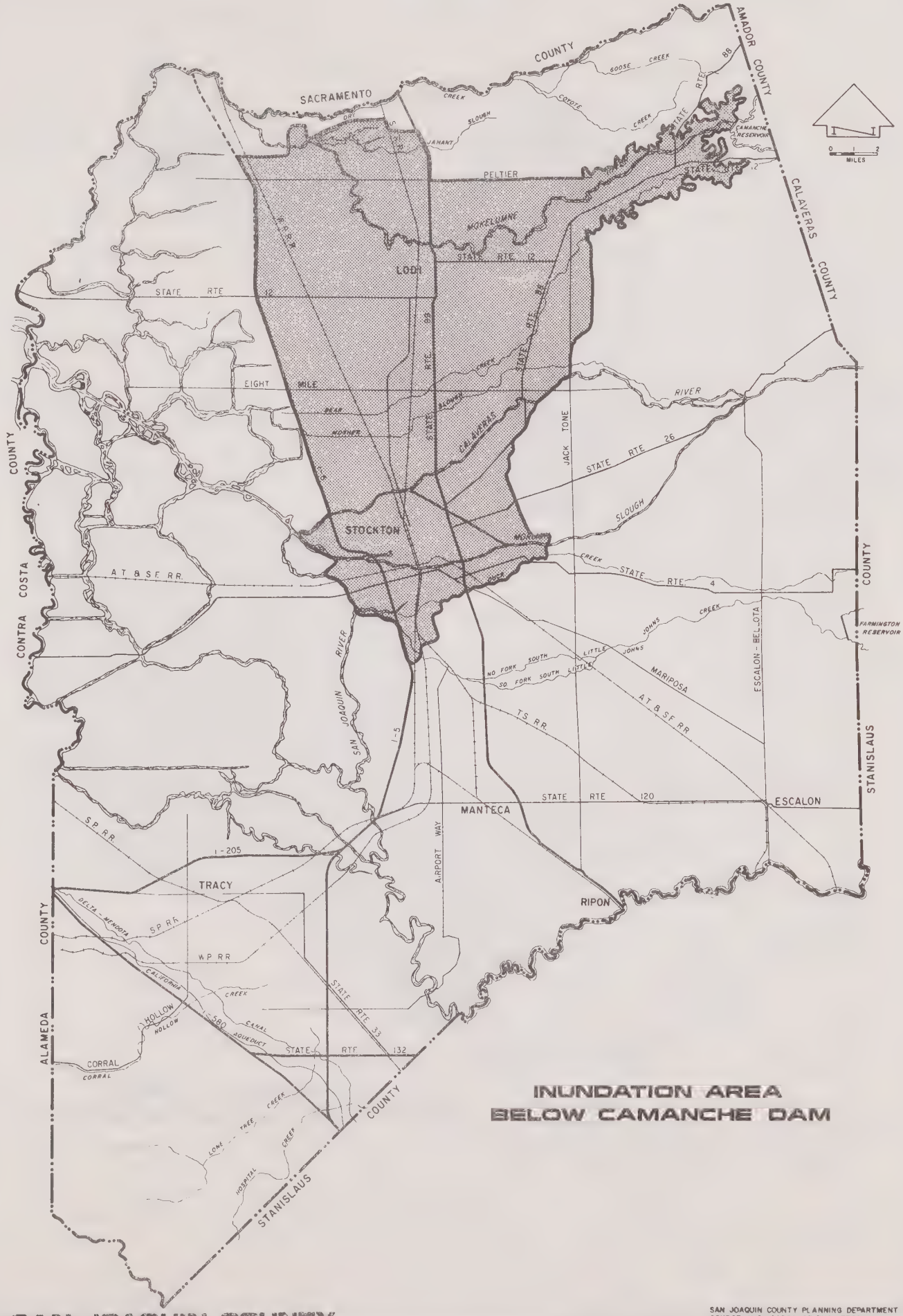
SOURCE: County and Cities Dam Failure Evacuation Plan, San Joaquin County Office of Emergency Services, 1977, 1978



SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/76
SOURCE: U.S. CORPS OF ENGINEERS

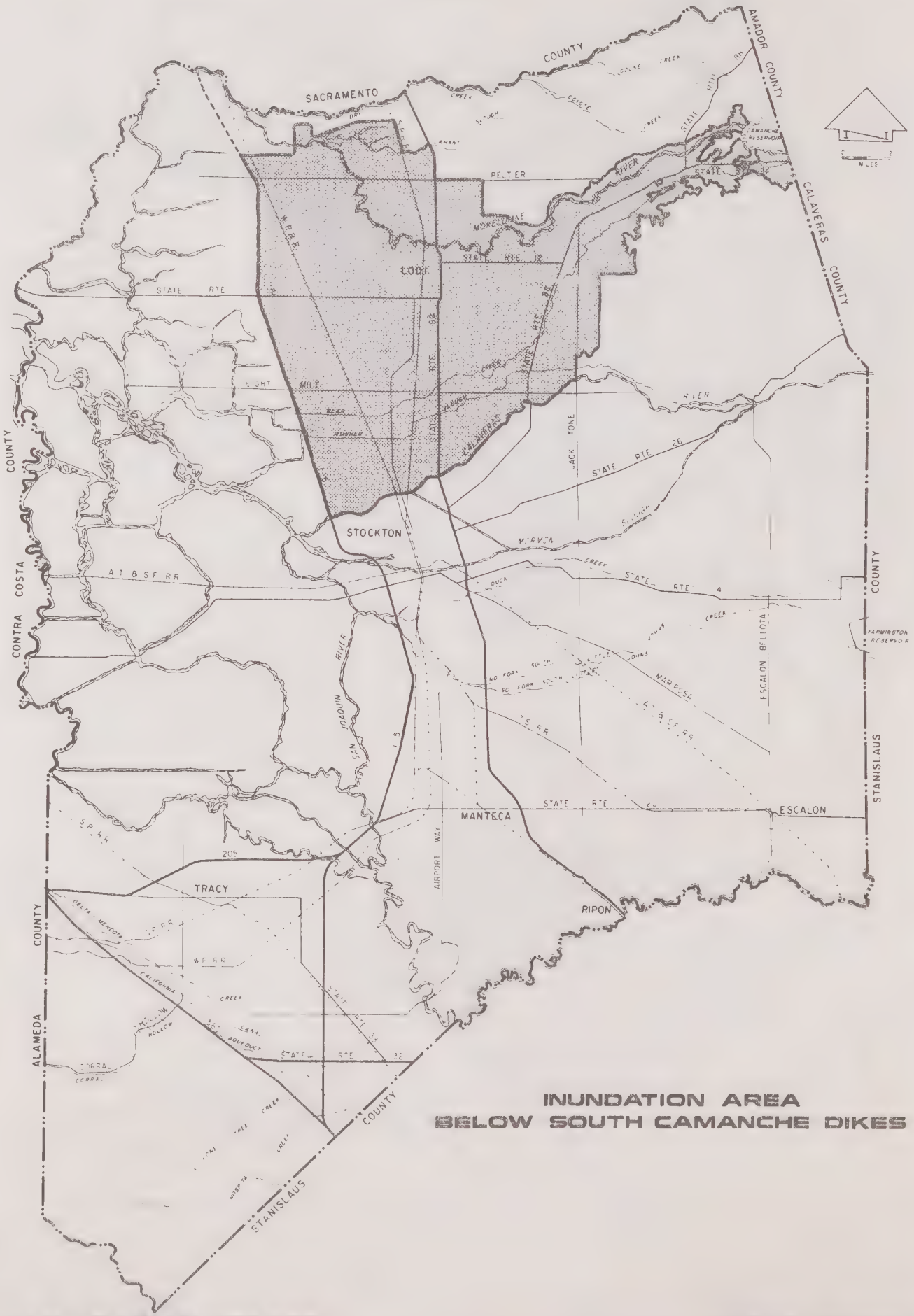


SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/78
SOURCE: U.S. CORPS OF ENGINEERS



SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/78
SOURCE U.S. CORPS OF ENGINEERS

EXHIBIT III-26



SAN JOAQUIN COUNTY

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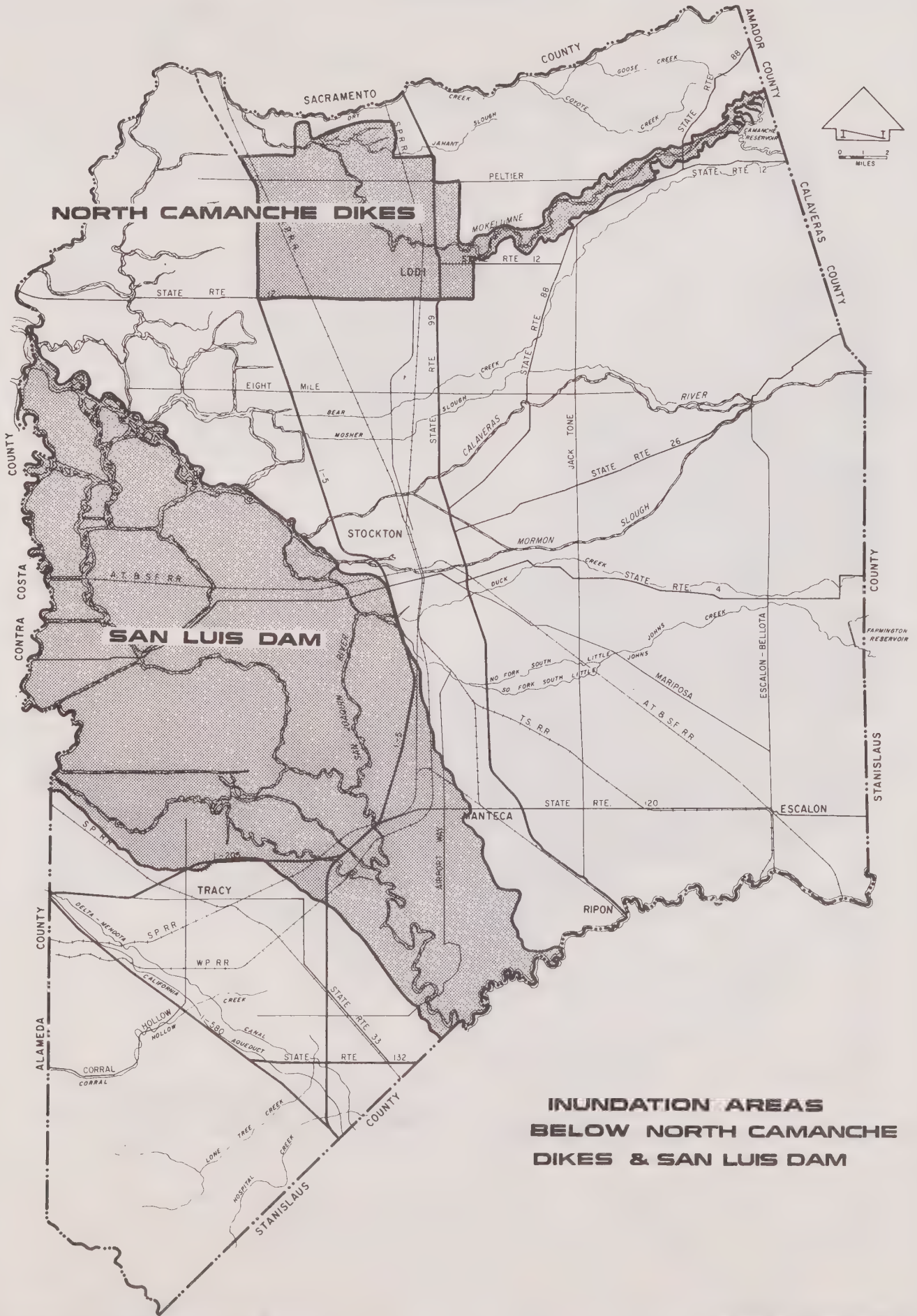
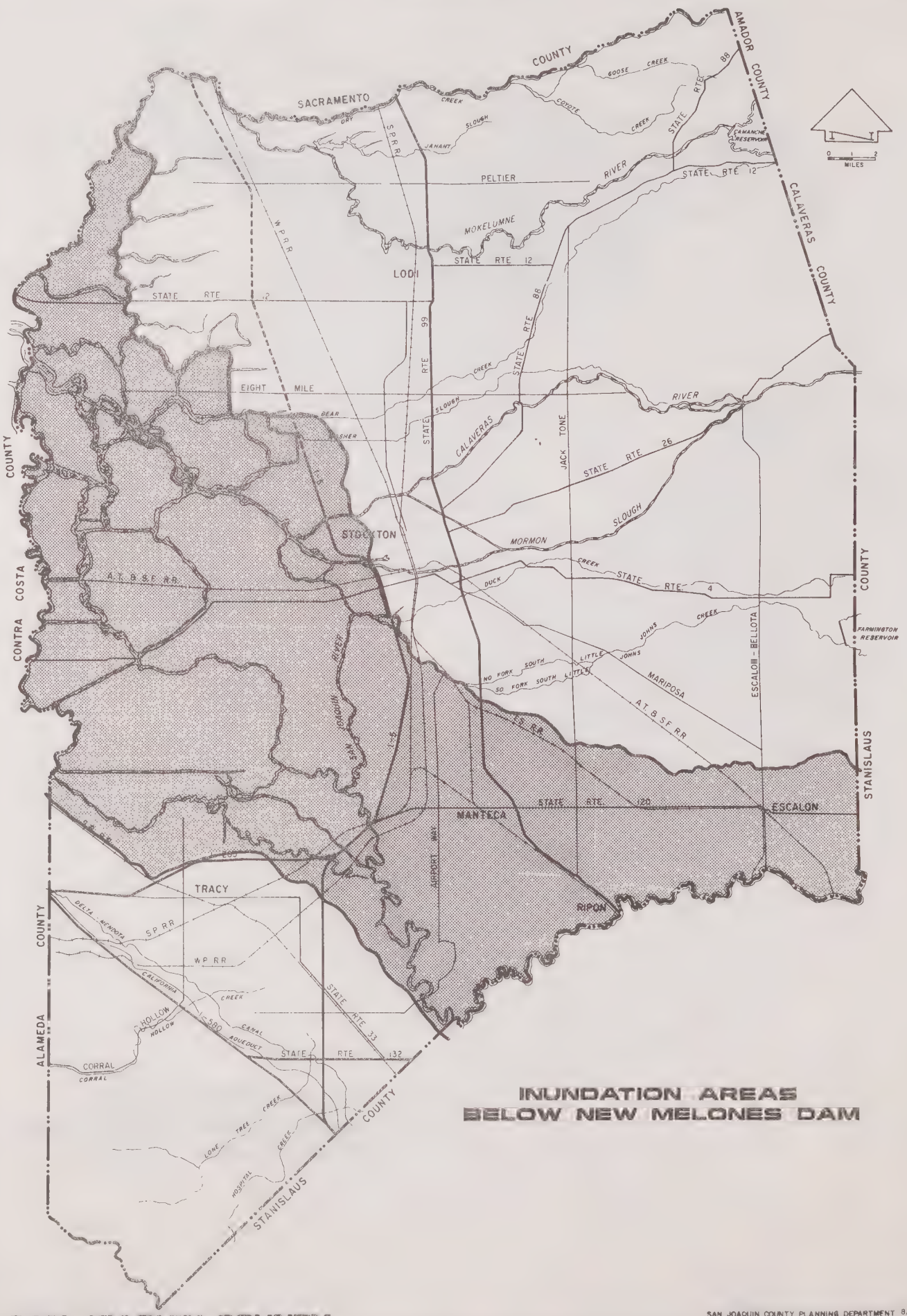


INUNDATION AREAS BELOW NORTH CAMANCHE DIKES & SAN LUIS DAM

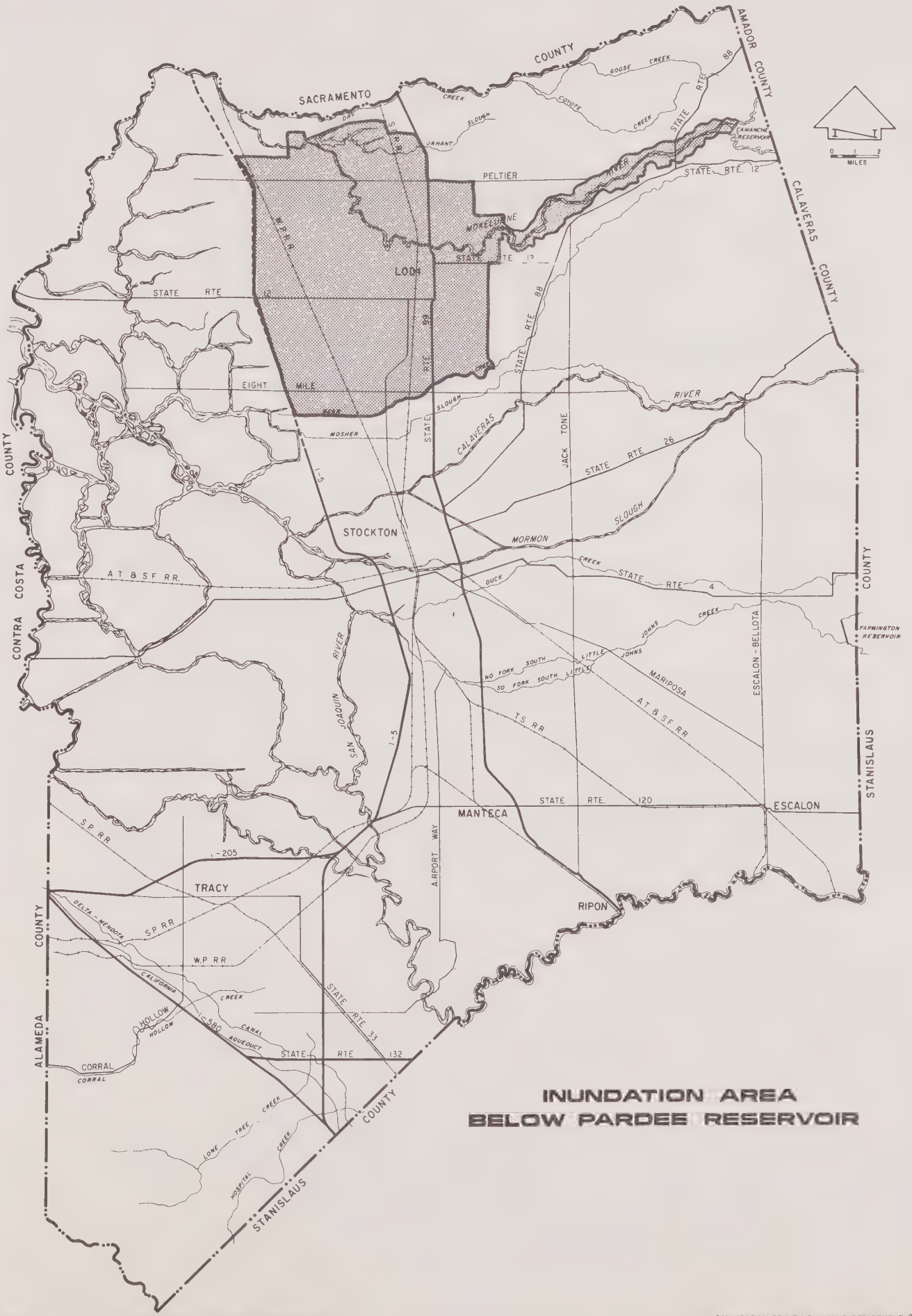
SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/75
SOURCE U.S CORPS OF ENGINEERS

EXHIBIT III-28



INUNDATION AREAS BELOW NEW MELONES DAM

SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/78
SOURCE U.S CORPS OF ENGINEERS



INUNDATION AREA
BELOW PARDEE RESERVOIR

SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/78
SOURCE U.S CORPS OF ENGINEERS

CHAPTER IV

FIRE HAZARDS

PRINCIPLES

1. Unincorporated urban fringe areas of cities should contract with the cities for fire protection services, or the formation of metropolitan fire districts should be considered.

2. Unprotected areas outside the Delta should be required to annex to an adjacent fire district prior to any project approval.

3. The County shall promote the establishment of both land and water based fire protection in the Delta.

4. Water systems in urban centers should be adequate for fire protection.

5. The use of cisterns, in lieu of water systems, should be investigated for fire protection in non-urban areas.

6. New industrial and commercial development in the County must be served by a water supply adequate for fire fighting.

7. Emergency power for water systems shall be required in all developments in order to permit adequate fire protection in a power failure.

8. Structures which contain chemicals or other materials which are likely to create a public hazard in a fire should be located away from populated areas.

IMPLEMENTATION ACTIONS

1. The County should participate in a LAFCO study of consolidation of fire districts. (Fire Warden, Planning, LAFCO)

2. The future of fire districts as a result of Proposition 13 should be analyzed. (LAFCO, County Administrator, Fire Districts)

3. The County should adopt the 1976 Uniform Fire Code of the California Fire Chiefs Association. (Fire Warden)

4. Water system standards which ensure adequate fire flows should be incorporated into County codes. (Fire Warden, Public Works)

5. The San Joaquin County Fire Chiefs Association should be asked to prepare fire safety recommendations for isolated industrial and commercial development to be submitted to the County for review and incorporation into building and zoning ordinances. (Fire Warden)

6. The fire protection needs of Rural Residential Areas should be analyzed. (Planning Commission)

7. The County will continue to assist the unincorporated communities in obtaining funding for improvement of their water systems. (Planning, County Administrator, Public Works)

8. The County's zoning ordinance will be reviewed and revised as necessary to permit adequate control over locations of structures in which there is manufacture or storage of materials which could create a public hazard in a fire. (Planning)

9. In order to be aware of the types and locations of hazardous materials, fire fighters should perform regular inspections of structures in which there is manufacture or storage of materials which could create a public hazard in a fire. (Fire Districts)

10. Regular fire inspections should be made of group assembly and group residential structures. (Fire Districts)

11. The County and fire districts should continue to work together to properly locate fire stations in relation to existing development and projected growth. (Planning, Fire Districts)

12. Proposed development will be reviewed for compatibility with adjacent land uses and investigation of fire hazards. (Fire Districts, Fire Warden, Planning)

13. The County Fire Warden should continue to assist the fire districts in inspections, training, investigations, and fire prevention and education activities. (Fire Warden)

14. The County Bureau of Fire Prevention should collect and retain county-wide fire statistics. Data gathered by the State should be made available without charge to the County. (Fire Warden)

15. Sheriff's patrol boats should be equipped with portable pumps and hoses for emergency fire fighting. (Sheriff)

INTRODUCTION

In San Joaquin County, as elsewhere, fires are a persistent hazard to life and property. The County had 3,158 fires in 1977.

Exhibit IV-1

FIRES IN SAN JOAQUIN COUNTY, 1977

Type of Fire	Number	% of Total
Building	869	27%
Grass	771	24%
Vehicle	726	23%
Refuse	477	15%
Outside Structure	202	6%
Explosion	1	1%
Outside Storage	18	1%
Mobilehome	28	1%
Other	62	2%
Unknown	4	1%
	3158	100%

A breakdown by geographical area is not possible. Since 1974, with the establishment of the California Fire Incident Reporting System, the State Fire Marshal's Office has been collecting fire data from the individual fire districts. The system is designed to provide comprehensive collection and analysis of data. Unfortunately, once the State began collecting data, local fire districts stopped reporting to the County Fire Warden's Office. Data available from the state is only on a county-wide basis, and it is therefore, impossible to use the data in pinpointing problem areas or geographical trends in fire incidents.

The majority of fires affect only their immediate areas, but some become public hazards. A public hazard can occur when a fire spreads to adjacent properties, when hazardous materials are involved, when transportation routes become blocked, when there is interference with the normal servicing of a community, or when the fire protection services are over-extended and are not capable of responding to additional emergencies.

SPECIAL FIRE HAZARDS

There are several types of fire hazards which deserve special discussion, either because of their importance in the County or because of their potential impact on a large number of people.

Rangeland, Brush, and Grass Fires

These fires are an annual hazard in San Joaquin County and account for more than half the fires occurring in the unincorporated areas. Summers are long, hot, and dry, with temperatures often exceeding 100°F. Where there is easy human access to dry vegetation, fire hazards increase because of the greater chance of human carelessness; high hazard areas include outlying residential parcels, open lands adjacent to residential areas, and unirrigated parklands.

The grass-covered, dry grazing lands of the eastern and southwestern foothills have a high potential for large-scale fires. The degree of hazard in these areas depends on several factors: temperature, moisture, wind, "fuel loading", slope steepness, accessibility to human activities, and accessibility to fire fighting equipment. "Fuel loading" refers to the type and amount of vegetative fuel available for burning. Steep slopes increase fire hazards because they are not as accessible to fire fighting equipment and have a fire spreading effect similar to high winds.

Gas Fires

Natural gas fields, gas storage wells, and gas pipelines, all concentrated in the Delta, also pose potential fire hazards. On May 17, 1974, a fire began at the Pacific Gas and Electric facilities on McDonald Island and burned out of control for 19 days. Fortunately, such fires are unusual.

Peat Fires

The peat lands of the Delta are hazardous fire areas. Peat fires can be caused by discarded cigarettes and matches, by agricultural burning, or by spontaneous combustion of the continuously decomposing organic matter. A fire in peat soil can burn underground and can continue to smolder for months, erupting unpredictably even after the fire is presumed to be extinguished. Even flooding of the land may not put out the fire. In addition to the fire hazards, burning peat can result in pockets of air beneath the ground surface, which can sink or collapse. (See Chapter II for discussion of subsidence.) Fortunately, there is no urban development in the areas of peat and none is planned, due to the multiple hazards of the Delta area. (See Chapter II, Geologic Hazards, and Chapter III, Flood Hazards.)

Chemical Fires

Industries which manufacture, store, handle, or transport petroleum, explosive, and other flammable materials create special fire hazards. A potentially disasterous situation occurred in Lathrop in 1976, when a fire broke out at a chemical plant. At the height of the blaze two to three dozen drums of weed oil exploded, feeding the fire and melting the metal building where they were stored. A 750 gallon tank of isopropyl alcohol was located about 600 feet away. Explosion of that tank could have triggered an explosion of liquid ammonia tanks, causing extensive damage and spreading deadly chemicals throughout the Lathrop area.

It is important that local fire districts be aware that hazardous materials are being stored and that the fire fighters know the types and locations of the stored materials. In the event of a fire, knowledge of the extent of the hazard can permit early evacuation of nearby areas, if necessary.

Knowledge of the type of hazardous material is also necessary in order to properly and safely fight the fire. For example, organic phosphates, which are heavily used (and stored) pesticides in an agricultural county, could cause a disaster. Water vaporizes organic phosphates. In a fire this vapor can rise, be blown over a populated area and settle. It is absorbed through the skin and acts like nerve gas! Organic phosphates would not pose as serious a danger if allowed to burn.

FIRE PROTECTION

The degree of fire protection which an individual property or an area receives is dependent upon a number of factors: fire protection regulations capability of the department (personnel and equipment), adequate water availability, accessibility to the fire, and response time. These factors are also considered by insurance companies in determining fire insurance rates. It is often found that the cost of providing a higher degree of protection is offset by the reduction in the cost of fire insurance.

Fire Protection Regulations

The County has adopted the Fire Prevention Code prepared by the American Insurance Association. Another set of regulations, the Uniform Fire Code, 1976, is available. Since it ties in with the Uniform Building Code, the County should consider its adoption to replace the existing 1970 regulations. Other County regulations which pertain to fire protection have to do with water systems and will be discussed below.

The County Fire Warden's Office serves as a review and enforcement agency for the County regulations. This office, also known as the Bureau of Fire Prevention, assists the local departments in inspections, investigates all possible arson fires, and instructs in and develops fire prevention methods. The Fire Warden is responsible for reviewing all business licenses in order to determine compliance with the fire regulations.

Fire Protection Agencies

Fire protection in San Joaquin County is primarily provided by the cities of Stockton, Lodi, Manteca, and Tracy and 19 fire districts.[1,2] Numerous specialized agencies also provide protection. County safety personnel at Stockton Metropolitan Airport are responsible for crash and rescue efforts at the airport. In the foothills, the State Division of Forestry provides basic watershed fire protection. other specialized fire services are located at the U.S. Naval Communications Station, Sharpe Army Depot, Tracy Defense Depot, Deuel Vocational Institution, Northern California Youth Center, and the Lawrence Radiation Laboratory.

Each of the County's fire districts is governed by an elected board. All of these districts use volunteers and 16 have at least some full-time fire fighters. Farmington, Forest Lake, and Escalon Fire Protection Districts are totally volunteer departments, with Escalon considering consolidation with the surrounding Escalon Rural County Fire Protection District.

All public fire protection agencies in San Joaquin County operate under a master mutual aid agreement. When a fire agency's normal facilities are exhausted, other fire departments may be called in to provide assistance at no charge to the responsible fire agency. In addition to mutual aid, which involves a request, some fire districts have automatic response areas. If

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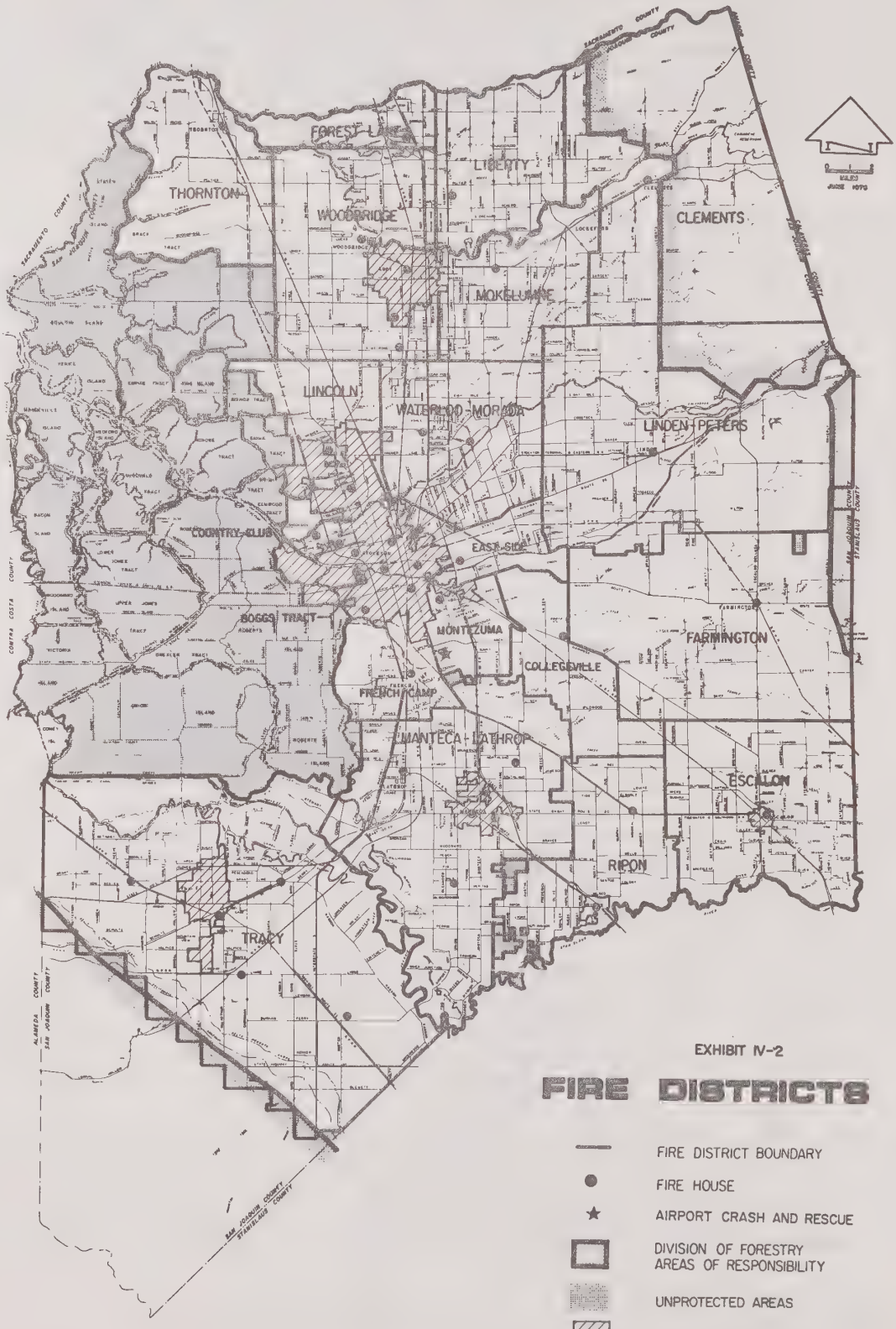
[1]Another district, Lincoln Rural Fire District, contracts with the City of Stockton for fire protection.

[2]Escalon City and Rural Fire Districts are included here as one district; although governed separately, they use the same personnel and equipment.



SAN JOAQUIN COUNTY

SAN JOAQUIN COUNTY PLANNING DEPARTMENT

a structural fire should occur in an automatic response area (generally an area remotely located from all the district stations), all districts which have entered into the agreement will respond automatically, ensuring an increased amount of available water to combat the fire.

FIRE PROTECTION PROBLEMS AND NEEDS

Levels of Protection

The level of fire protection varies in the County. Rural levels of protection cannot be as high as those of urban areas. The more densely developed areas have the full-time departments, the stations nearby, and the water supply to respond quickly and fully, thus preventing spread of the fire and in many cases major losses. In rural areas such levels of protection are not economically feasible or justified. Residents of these areas cannot expect urban protection levels. The fire stations are generally located in the small towns or geographically centered within their district boundaries.

Potential problems occur when new residential development is scattered throughout the district or enclaves of rural residential homesites develop. In a few areas of rural residential development, such as Morada, some homes are served by a community water system and some have their own wells. The houses may be close together and there is a possibility for a large fire.

The overlapping of a single district into both urban and rural areas has created some problems in protection. A rural district may be accustomed to using a tanker and not care to be "bothered" with a public water supply. A city, on the other hand, will not even have a tanker and ill equipped to fight rural fires. Special apparatus is also required to fight the moving grass, barley, and wheat fires. Most city equipment is not set up to fight the moving fire.

Since in the metropolitan areas the fire district boundaries reflect the city limits, the district boundaries may be very irregular. Boundary irregularity causes confusion in determining the proper department to contact for a fire and adds to the costs of providing protection because of the duplication in manpower and equipment and, in some cases, the need to cross other districts in order to get to an outlying area.

As cities annex land, the area to be served by the rural district decreases and a district can find itself with excess equipment and personnel. At the same time, the assessed valuation of the district decreases. Tax rates must then increase, as the district limits permit, and ultimately the property taxes are no longer adequate for funding to maintain the district with the same level of services. As service levels drop, fire insurance rates rise.

The impact of city annexation has been particularly evident in Stockton. To prevent the above sequence of events from occurring, the Lincoln Rural Fire District decided in 1977 to contract with the City of Stockton for fire protection. The French Camp Rural District was forced to abandon one of its stations, in the Taft School area. The Boggs Tract District has the highest tax rate of all districts in the County, and it is still unable to maintain a high level of protection. If these urban fringe districts are to remain in existence at all, they must contract with the cities for protection.

With the passage of Proposition 13 last June, the entire organizational structure of fire protection in San Joaquin County, as in other counties in California, must be reexamined. The districts' share of property tax revenues will not be adequate to maintain their operations. Various proposals have been made for county-wide consolidation of districts or the formation of one or more community service districts. Funding would then be provided by service charges, the basis for which would have to be determined.

In the reexamination of the district structure, the problems of urban and rural protection, particularly in the uninincorporated urban fringe areas, needs to be carefully considered. This is a good opportunity to solve many of the problems of costly duplicate services, and unnecessarily varying levels of protection.

Water Supply and Pressure

In the rural areas, the water supply for fire extinguishment must be trucked to the site. In some of the more remote areas, for extensive rangeland fires, aerial supplies may be brought in. Isolated industries will often have their own on-site water for fire fighting. In more densely developed areas it is feasible and important to have public water supplies with adequate capacities and pressure for handling the peak water load demands needed to put out fires. Emergency power sources are needed in case of a power failure.

The Urban Centers of the County generally have community water systems with hydrants (5). However, there are a few urbanized areas without hydrants (Exhibit IV-3). New subdivisions in the unincorporated portion of a city are required to hook up to the city's water supply (14).

The County's Rural Centers generally have less adequate water availability, if a community system is even existing (Exhibit IV-3). No substantial growth is planned for the Rural Centers.

Some of the County's Rural Residential Areas have water systems, but generally this development receives its water from individual wells. Although the lots are usually large, and the number of houses in a given area limited, there are a few extensive areas of rural residential development. In these areas a public water supply is advisable.

The areas with inadequate systems could install 10,000-15,000 gallon underground cisterns, using old fuel or water tanks. This would greatly assist fire companies, which carry only about 500 gallons on their regular trucks and about 2500-4000 gallons on a tanker. A community pool, with a draft pipe leading outside the fence, could serve as a cistern.

New Areas

New water systems are reviewed by the County Fire Warden and the local fire district for adequacy for fire protection. The County Subdivision Ordinance (6) presently contains requirements for new systems and a revised ordinance (12) will contain additional requirements, including the following:

1. a public water system in any subdivision with five or more homes
2. one well for every subdivision with five to twenty homes
3. two wells for every subdivision with more than twenty homes

Exhibit IV-3

WATER SUPPLY PROBLEMS
IN URBAN AND RURAL CENTERS

METROPOLITAN URBAN CENTERS[1]	WATER SYSTEM In City	Unincorporated Area	MAJOR PROBLEMS FOR FIRE PROTECTION
Stockton	yes	in portion	No hydrants in a few fringe areas.
Lodi (& Woodbridge)	yes	in portion	No hydrants in the center of Woodbridge.
Manteca	yes	in Raymus Village	No major problems.
Tracy	yes	no	No public water in Larch Clover area.
Escalon	yes	no	No major problems.
Ripon	yes	no	No major problems.
UNINCORPORATED URBAN CENTERS[1]			
Lockeford		yes	Small diameter lines in center need replacing.
Thornton		Housing Authority system	Water system is being installed.
Linden		yes	No major problems.
Lathrop		yes	No major problems.
French Camp		no	No public water.
UNINCORPORATED RURAL CENTERS[1]			
Clements		yes	Inadequate water system.
Farmington		in portion	Private system covers only part of community; no hydrants.
Acampo		yes - from winery	No major problems.
Henderson Village		in Sunnyside Estates	No system in most of the community.
Vernalis		no	Public system being planned in recently approved subdivision.
Coopers Corner		hydrant at Houston School	No public water system.
Banta		few connections to a private system	No hydrants.
Victor		yes	No major problems.
Simms Station		no	No public water

[1]Centers are defined by the Land Use/Circulation Element (7).

Exhibit IV-4

WATER SYSTEM STANDARDS

I. Required Fire Flow - Residential Districts	GPM	DURATION
A. Buildings of small area, low height and large lots.	500	2 hours
B. Buildings of larger area, or higher and more closely built.	1,000	3 hours
C. High valve residences, apartments, tenements, dormitories, or similar structures	1,500 - 3,000	4 hours

II. Hydrant Pressure - a minimum residual water pressure of 20 psi is required during flow, (may be reduced to 10 psi where hydrant spacing and main size requirements are met and where all hydrants are provided with at least one 4½" outlet and such outlet is normally used by the fire department).

III. Water Main Size

A. Minimum size shall be 6"; where blocks exceed 600' in length with no cross connections, main size shall be 8".

B. Minimum size in high valve districts shall be 8" with intersecting mains in each street and 12" on principal streets and where long lines exist that are not connected to other mains at intervals close enough for proper mutual support.

C. Gate valves shall be so located that no single case of accident, breakage or repair to the pipe system, exclusive of arteries will necessitate the shut down of an artery or a length of pipe greater than 800 ft.

IV. Hydrant Distribution

A. One hydrant shall be provided for each 120,000 square feet served by the system. Approximately 500' separation between hydrants.

B. Hydrants shall have at least 2,2½" outlets. In high valve areas, hydrants shall have one large pumper outlet and at least one 2½" outlet.

C. Street connections shall be not less than 6" in diameter.

D. A gate valve shall be provided on all connections between hydrants and street mains.

V. Reliability of Supply

A. Pumps shall, if possible, receive electrical power from separate sources to insure reliability.

B. Automatic motor driven power sources or adequate storage sources may be considered in lieu of the two separate sources of public utility power.

4. wells to be capable of supplying the minimum required fire flow specified by the County Fire Warden
5. system pumps to receive electical power from separate sources

In review of new water systems, the County Fire Warden uses the standards in Exhibit IV-4 (7). These standards are comparable to those published in a study of the National Bureau of Standards, although the latter recommends a minimum water main diameter of 8 inches. The County should incorporate these water system standards into its ordinances.

Response Time

The time between the start of a fire and the arrival of the fire department can be crucial. This response time can be affected by confusion over what department to notify, the distance from the station to the fire, and the accessibility of the fire. On the urban fringe, the wrong department is often notified of a fire, but the calls are transferred to the proper department. A 911 emergency phone number would help in avoiding delays (See Chapter VII, Emergency Preparedness.) The City of Stockton is in the process of developing an automatic dispatching system, which should help response time in the metropolitan area.

In rural districts the station may be a long distance from the fire. Scattered urban-type developments and numerous homesites in these rural areas can be fire protection problems. Such development is often too far from fire stations to permit reasonable response times, yet they are not large enough to justify or pay for a new local station (11).

Accessibility

The response time is also affected by the accessibility of the fire. Most county-maintained roads are adequate for rapid arrival of fire fighting equipment. Private roads, however, might not be. Adequate pavement-width should be required on all roads. On cul-de-sacs the radius needs to be sufficient for turning of fire equipment. Some homes in rural areas are located on dirt or gravel roads which are not even passable during the rainy season.

Finding the fire may itself be difficult. Flag lots are confusing, and structures in rural areas can be very difficult to locate. Locating the fire can be made easier if care is given to subdivision design, street naming and numbering, and placement of address numbers at the roadway. Multiple access to areas should be required.

Unprotected Areas

The entire area of the County should have fire protection. However, there are still a few small areas which are not in districts, and the Delta remains a major problem area (Exhibit IV-2).

The Delta is essentially without fire protection. Fires there are generally the responsibility of private individuals, although in the past there was a private company on Roberts Island which provided service on a contractual basis. The County Public Works Department responds when a fire threatens county roads.

Although there is no urban development in the Delta, and none is planned, there are more than 800 residential structures, some extensive recreational

developments, and four schools, on the combustible peat lands. Three major highways pass through the unprotected area: State Route 12, 11 miles; State Route 4, 14 1/2 miles; and Interstate 5, 3 1/2 miles when completed. Accidents on these roadways may need the assistance of a fire department.

Access to a fire in the Delta can be a problem. The road system in the Delta is minimal, with few bridge crossings of the waterways and a few islands are accessible only by ferry or boat. Much of the Delta's development, such as marinas and cabins, is accessible mainly or solely by water. Boat-traffic on the waterways is continually increasing.

Urban development is not planned in the Delta, but-recreation development, highway travel and waterway traffic will continually increase. A major interchange in the unprotected area, at I-5 and Route 12, is planned for Highway Service development (10).

Fire protection in the Delta needs to be both land and water based. A report prepared by the County Bureau of Fire Prevention details the problems of Delta fire protection and examines various alternatives for protection (9). It recommends either formation of a fire district[1] or contracting with "existing neighboring departments which can demonstrate reasonable response time to particular areas." Costs of providing fire protection would be at least partly offset by lower insurance rates.

The County can also assist in fire protection on the waterways. The Sheriff's Department could equip its patrol boats with portable floating pumps and hoses; use of these could delay the spread of a fire until the fire department arrives (9).

FIRE PREVENTION

Fire prevention programs include inspection of property for fire hazards, enforcement of weed abatement regulations, maintenance of fire trails in the foothills, and public education programs. Use of these prevention techniques varies throughout the County.

Although many of the cities have extensive inspection programs, a few districts and the County Bureau of Fire Prevention conduct only limited inspections. Additional personnel would be needed to do more. The only mandated fire inspection is the inspection which the state requires of schools once a year. Inspections should be done of those industries which pose a public fire hazard. In addition to those companies which deal in hazardous chemicals, any business which manufactures or stores a large quantity of combustible materials, such as lumber yards, should receive regular inspections. In order to be familiar with the types and locations of hazards, those people who will be fighting a fire should do the inspections. There should also be frequent inspection of structures for group assembly and housing.

City fire departments, the Bureau of Fire Prevention and some fire districts conduct active weed inspection and abatement programs. Lots with weed fire hazards can be posted and notices sent to the owners. If the weeds are not removed by the owner, it can be done by the district and the costs charged against the property.

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[1]Formation of a fire district may not be financially feasible since the passage of Proposition 13.

Since many fires are caused by negligence and carelessness, effective fire prevention programs can prevent a majority. The County Bureau of Fire Prevention should continue to act as the coordinating office for prevention programs.

CHAPTER V

CRIME HAZARDS

PRINCIPLES

1. Residents in unincorporated urban areas desiring urban levels of police protection should pay for it through special districts, contracting with a city for police services, or through annexation.

2. Scattered urban development and unincorporated fringe development around cities should be discouraged, because it is difficult and expensive to service.

3. The County should encourage the use of citizen action programs, such as Neighborhood Watch.

4. Projects should be reviewed to ensure that crime-inviting features are mitigated.

IMPLEMENTATION ACTIONS

1. The County departments, including the Sheriff's Department, should develop guidelines for defensible space design of buildings and subdivision projects. (Sheriff, Planning, Public Works, Building)

2. The County Sheriff's Department should continue to assist communities in setting up Neighborhood Watch Programs. (Sheriff)

3. The County Building Code should be reviewed for the adequacy of its crime prevention security measures. (Building)

INTRODUCTION

This chapter primarily describes planning-related opportunities which aid in the efficiency of providing law enforcement services and which incorporate crime prevention features into development projects. These features can result in greater public safety at relatively little public cost.

LAW ENFORCEMENT SERVICES AND PROBLEMS

Law enforcement in San Joaquin County is provided by each city for their incorporated areas and by the County Sheriff's Office for the unincorporated areas. The California Highway Patrol maintains routine patrols and investigates traffic accidents on roads in unincorporated areas.

The County has a large unincorporated population (35% of the total County population) which is protected by the Sheriff's Department. The Sheriff's Office patrol division is located south of Stockton along with the jail facilities in French Camp. There are no substations; however, programs of patrolling have been instituted on a district basis.

The Sheriff's Department is funded to provide rural police protection throughout the County's unincorporated area. Urban levels of protection are not possible in most areas without a change in the function of the Department, and a substantial increase in cost. This cannot be justified county-wide since financing of the Sheriff's Department is borne by all County residents, not only those in the unincorporated areas.

A measure of the difference between urban and rural levels of service is the response time. Not surprisingly, the Sheriff's Department, on the average, takes a longer time to respond to a call for assistance than do the city police departments. Factors that combine to cause these response time differences include the size of the area and the density of the population served, the level of traffic congestion, accessibility, and the number of incidents occurring at the same time. The size of the area and the density of population to be served determine the size and frequency of the patrol beat.

Those who live in the agricultural and rural residential areas of the County should not expect the frequency of patrol and fast response time possible in the larger urban centers. At the same time, the County should not permit new scattered clusters of development-which are difficult to service efficiently.

At the present time, scattered unincorporated urban areas are too small to justify a full-time patrol. In some of the County's unincorporated urban centers, such as Lockeford and Lathrop, the residents may wish a higher level of public protection. If so, it is possible for them to finance it through a special district and provide it locally.

In the larger incorporated urban centers, irregular jurisdictional boundaries result in duplication of services. Sheriff's Deputies often cross through incorporated cities to patrol other unincorporated areas while city police cross unincorporated areas to patrol city areas already crossed by the Sheriff's Department. This is a costly duplication of services in terms of time and

money. The County could conceivably work out a contractural agreement with the cities to service these unincorporated areas.

The irregular jurisdictional boundaries also can cause confusion and delay response to day-to-day emergencies. While jurisdictional problems are difficult to resolve under present annexation laws, confusion on the part of the caller as to who to call could be eliminated by implementation of a uniform 911 emergency telephone number. This would be dialed in any emergency and trained operators would handle the call. Tracy now has such a system. The rest of the County must implement 911 by December 31, 1985, under a state-mandated deadline. At the present time, there is still uncertainty regarding various funding aspects of the program.

CRIME PREVENTION THROUGH PHYSICAL PLANNING

Citizen action has been shown to be an effective means of combating theft and preventing other types of crimes. Citizen action can be facilitated by the creation of "defensible space."[1]

Defensible space is a concept of designing buildings and neighborhoods to achieve the following objectives:

- to promote the proprietary interest of residents in neighborhood or apartment complex activities;

- to permit the identification of suspicious happenings or persons (in part by increasing recognition of neighbors); and

- to make it evident to the potential criminal that he or she could be observed and could very likely be apprehended.

Much crime is crime of opportunity rather than premeditated crime. Thus "defensible space design," which tends to promote citizen surveillance and action, is an important concept for reducing crime--and it offers an alternative or supplement to locks and bolts or other mechanical devices.

Design features for the creation of defensible space include the following:

- a visually well defined separation between public and private areas;

- windows placed for easy resident surveillance of yards, corridors, entrances, streets, and other public and semi-public places;

- landscaping which permits surveillance of open areas and entryways and does not provide places for concealment;

- design which relates grounds to particular dwelling units in apartment complexes so the residents recognize certain areas as for their use, and take an interest in them;

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[1]This section is based on and partially excerpted from Oscar Newman, Defensible Space (2).

- delineation of city streets to create territorially defined blocks and areas by closing or modifying existing streets and designing new streets to restrict but not exclude vehicular movement (However, access and adequate turnaround radii for emergency vehicles is important and street patterns should facilitate patrol observation);

- elimination of undefined hallways, particularly double-loaded corridors, shared by a large number of families. Entries and circulation corridors should be designed so that as few families as possible share a common lobby. This facilitates recognition of strangers;

- well-lighted streets, entrances and house numbers;

- well-lighted and windowed apartment stairwells where possible;

- well-positioned apartment lobbies or condominium recreation rooms that can be surveyed from the street;

- location of kitchen and living areas to facilitate surveillance;

- limitation of access into and between buildings so escape routes are fewer and undetected entrance is more difficult.

These design features were shown to provide a greater degree of crime deterrance than did better locks, etc., in urban public housing projects which were studied.

Similar defensible space techniques and other security precautions have been defined for other types of uses.

For Industrial and Commercial buildings the following general design principles can be applied:

- Landscaping, location of buildings, walls, etc., should facilitate surveillance from the street and from neighboring structures and not provide places for concealment.

- The street system should allow emergency vehicle access around the buildings.

- Parking, walkways, etc., should be located where surveillance from streets or from an attendant is possible to reduce worker or customer isolation when walking to and from cars.

- Access to buildings or ground groups of buildings, and access between buildings should be limited so escape routes are fewer and entrance is made more difficult.

- Access to roofs by parking structures, pallets, flagpoles, etc., should be eliminated or avoided.

- Windows should be held to a minimum on the first floor, if possible, and windows made burglar-resistant.

- Buffer zones (walls, parks, busy streets) should be provided between industrial and commercial areas, and surrounding areas to make it more difficult to escape unseen.

- If possible, areas should be designed so they can be sealed off when not in use.

- Alarm systems should be installed if possible on a zone basis so the entire area does not have to be sealed off in an emergency.

- Street names and building numbers should be well lit for easy identification.

Recreational area design features for crime prevention include:

- good lighting;

- designs which facilitate surveillance from streets and nearby buildings;

- location of park buildings and high use activities near streets.

Many defensible space principles are difficult to apply in low density residential areas or semi-rural areas where the desired lifestyle requires features which separate each home from others and from the road. In these areas, citizen action within the existing physical setting can be effective in reducing crime. For example, several jurisdictions in the County have instituted Neighborhood Watch or similar programs. These programs are intended to encourage acquaintance among neighbors, foster an attitude of caring for neighboring property, promote permanent identification marking of household items, and encourage the display of signs on property indicating valuable items have been marked. Under the Neighborhood Watch Program, San Joaquin County has 45 established groups, Stockton has 286, and Tracy has 3. All of the jurisdictions feel the program is effective and point to localized reduction in crime. Similar programs have been found to be effective elsewhere. Two weeks after a Neighborhood Alert program was instituted in West Pittsburg, all crime was reduced by 50%. Similar reductions in burglary were noted in other neighborhoods. There were marked increases in calls to law enforcement agencies from residents reporting suspicious circumstances; also there was an unwillingness of thieves or fences to take marked property.

In addition to the above approaches, at least two jurisdictions (the County of Los Angeles and the City of Oakland) have incorporated crime prevention security measures into their building codes. In commercial areas, building codes require certain types of locks on doors and windows, reinforced door jamb construction, hinges with nonremovable pins, door constructions which cannot be kicked or broken through easily, adequate lighting, certain windows made of burglar resistant materials, and locking or securing any hatchways, air vents, air ducts or skylights of a certain size. In residential areas building codes cover exterior door and door jamb construction, locks for doors and windows, some window constructions (notably louvered windows) and hinges.

Informal advisory services may also be provided to business owners, firms, builders or homeowners to show them how buildings may be made more secure.

CHAPTER VI

HAZARDOUS MATERIALS

PRINCIPLES

1. Isolated areas should be provided for those uses or facilities which may involve the storage or manufacture of hazardous materials.

2. Fire districts in which identified hazards are located should be encouraged to prepare emergency plans.

3. The interface between urban and rural residential areas and agricultural areas should be minimized to reduce the risk of accidental contact with pesticides or other chemicals used in agricultural operations.

4. The risks involved in the transportation of hazardous materials should be considered when reviewing planned land uses near major routes.

IMPLEMENTATION ACTIONS

1. The County zoning ordinance should be reviewed and revised as necessary to permit adequate control over locations of structures in which there is manufacture or storage of materials which could create a public hazard. (Planning, Fire Warden)

2. All precautions which are presently being undertaken in the storage of hazardous materials should be evaluated. (Fire Warden, Fire Districts)

AGRICULTURAL CHEMICALS[1]

San Joaquin County, as would be expected with its agricultural economy, is a heavy user of agricultural chemicals, many of which pose a potential hazard. Yet chemical pesticides are an essential element in maintaining the yields of modern agricultural production. In order to assure the safety of people, property, and the environment, pesticide regulations are strongly enforced by the County Agriculture Department. This many-faceted program involves environmental protection from pesticides contamination, elimination of residues on food stuffs, protection of persons, animals, and property from pesticide misuses, prevention of fraud and deception in pesticide sale and application, and assurance of success in pest control.

The program includes:

1. Enforcement of county and state laws and regulations concerning restricted materials, restricted herbicides, and other economic poisons, licensed agricultural pest control operators, pest control advisors, pesticide dealers, growers, and others.
2. Evaluation of requests for restricted material permits, and issuances of refusals.
3. Inspection of properties, crops, equipment, safety devices, and clothing for safety, drift hazards, and re-entry time.
4. Supervision of applications and proper disposal of pesticide containers.
5. Review of records required to be kept or submitted by dealers, agricultural pest control advisors, pest control operators, growers, and others.
6. Investigation of complaints, damages or losses resulting from applications of economic poisons by other than licensed agricultural pest control operators.
7. Aid in the examination of pest control operators and agricultural pest control advisors.
8. Inspection of equipment, pest control operator or grower application methods, materials, proper storage and effectiveness of treatments.
9. Collection, preparation and submission of specimen for laboratory analysis.
10. Investigation of complaints.
11. Collection, preparation and presentation of evidence at hearings and prosecutions and conducting hearings.
12. Preparation and promulgation of county regulations.

The use of pesticides to protect crops of major economic importance is fundamental in today's agriculture. These materials enable growers to produce crops, livestock, and livestock products of good quality at minimal costs, thus providing the consuming public a supply of such products at reasonable proces.

In recent years there has been a proliferation of materials used to control pests. Many of these pesticides are highly toxic to humans, animals or plants, thus they become highly hazardous unless used according to prescribed safety practices.

The Director of Agriculture of the State of California has established a list of restricted materials based upon their danger to public health, hazard to applicators and farm workers, hazard to domestic animals, including honeybees, hazard to crops and to the environment in general. Regulations have been adopted governing the application of these pest control materials. The regulations prescribe the time, conditions of use and other safety precautions. Both commercial pest control operators and growers must obtain a use permit from the County office to buy and use any of these restricted materials.

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[1]The following section has been excerpted from a publication of the San Joaquin County Department of Agriculture entitled "What We Do".

With regard to agricultural operations, nearby residents, as well as agricultural workers, are susceptible to the hasards resulting from the application of pesticides or other agricultural chemicals. This is especially true of those rural residential areas where people generally unaware of agricultural practices may live. For example, children may accidentally run through fields or orchards ignoring any warning signs. The potential for injury increases as more non-farm families move to rural areas.

NATURAL GAS AND PETROLEUM

Many miles of pipelines for the transportation of natural gas, crude oil, and refined petroleum products criss-cross San Joaquin County. These pipelines pass through population centers as well as the rural areas. The risk of damage to the lines from an earthquake is unknown. The maximum probable earthquake in San Joaquin County is VIII or IX on the Modified Mercalli Scale. An earthquake of intensity IX will break some underground lines.

Natural gas is believed to present less of a hazard to the public than petroleum products because it is transported at lower pressures and when released, rises and dissipates into the atmosphere. Petroleum is piped at high pressures and when released, flows along the ground. Thus, petroleum fires are most likely to spread to nearby property than vertical burning natural gas fires.

The petroleum industries and Pacific Gas & Electric (PG&E) are aware of the safety hazards of fuel pipelines and have worked to continually upgrade construction and safety equipment. Pipelines constructed since 1965 are constructed to more stringent industry standards than installations built prior to that date. In some cases, older pipelines have been improved.

Exhibit VI-2 identifies natural gas fields within the County. Natural gas and petroleum fields and storage wells and facilities also pose potential fire hazards. A PG&E natural gas underground storage reservoir, holding 50 billion cubic feet of gas, is located on McDonald Island. In May of 1974, a fire began during construction work and burned out of control for 19 days. At the present time, there are no proposals for liquified natural gas (LNG) facilities in the County.

Presently, gas well drilling is regulated by zoning ordinance and is permitted with an approved development plan or use permit, depending upon the area's General Plan designation. Applications are also subject to environmental assessment under the Environmental Quality Act. Excluding portions of the Vernalis, Galt and French Camp Fields, the County's known active gas fields are located beneath areas planned for continued agricultural use. Test and well drilling in all areas may increase as the demand for natural gas increases.

No known significant environmental problems, with the exception of the McDonald Island well fire, have been encountered as a result of gas drilling and production in San Joaquin County. Blowouts and fires are a possibility in drilling any gas well. Major possible impacts of such occurrences include: damage to property and loss of reservoir energy; danger of human injury; contamination of ground or surface waters; conflagration hazards; and disruption of surface land uses. The severity of the impact depends upon land uses in the area: the greater the density of development, the greater the damage. However, extreme precautions are taken and occurrences are very unlikely. Once a well is drilled, there are few problems; therefore, their development in urban areas is not unlikely. Additional considerations relative to gas fields and extraction are leaks, wastewater and subsidence.

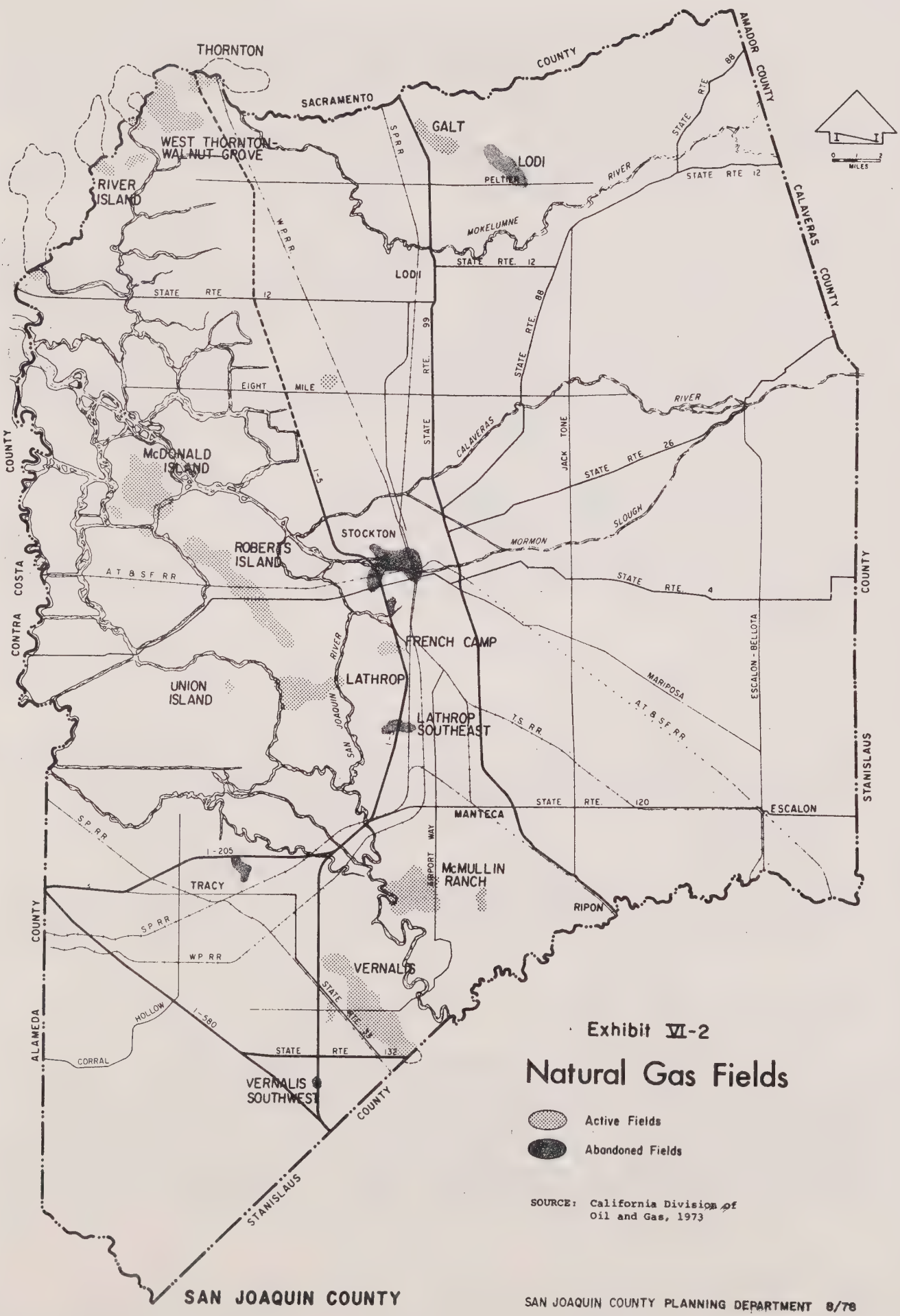

Exhibit VI-2

Natural Gas Fields

Active Fields

Abandoned Fields

SOURCE: California Division of Oil and Gas, 1973

SAN JOAQUIN COUNTY PLANNING DEPARTMENT 8/78

EXPLOSIVES

Explosives are currently being transported through San Joaquin County by both rail and trucks. Both the Santa Fe and Southern Pacific Railroads transport munitions to the Concord Naval Weapons Station in Contra Costa County, some of which are transported through San Joaquin County. Rail shipment of explosives is not regulated, but is normally maintained to the standards of the U.S. Department of Transportation for special car design and safety procedures for loading and switching. The railroad companies have initiated the practice of placing munitions cars on non-stop trains through populated areas.

Explosives in transit by truck are regulated by U.S. Department of Transportation national safety standards. The national standards have been incorporated into the California Vehicle Code and Health and Safety Code. Explosives and corrosives may only be transported on routes established by the California Highway Patrol (CHP), which issues citations for route and other violations. In addition, safe stopping and safe parking places are established by the CHP (Exhibit VI-3). Bridges have individual requirements for the passage of corrosive and flammable materials. Truck drivers are required to be provided with detailed written information on how to deal with the specific material being carried in case of an emergency.

Regulations are also applied to labeling, packaging, and loading of explosives, safety equipment on trucks and signing for public information. Permits are granted to trucking companies and can be revoked if violations are found. The limits of CHP manpower do not permit high levels of enforcement. No more than random spot checks are possible, yet numerous citations are issued. Permits for the use and storage of explosives are granted by the County Sheriff's Department.

RADIOACTIVE MATERIALS

Approximately 100,000 shipments of radioactive materials are made through California each year. Because of the location of the Lawrence Radiation Laboratory in San Joaquin County, the proximity of the Rancho Seco Nuclear Power Plant, and the availability of highway and rail facilities, radioactive materials are shipped through San Joaquin County and the possibility of an accident exists.

A permit from the State Department of Health is necessary in order to use radioactive materials. Permits granted in San Joaquin County are primarily to hospitals or medical groups, educational institutions, governmental agencies, and the larger industries.

OTHER HAZARDOUS SUBSTANCES

Extremely hazardous and toxic substances routinely pass through the County every day. The extent and degree of this hazard is not precisely known by any agency. Regulations are less restrictive than for explosives and these substances travel in a relatively free environment. The proximity of major transportation routes to population centers adds to the risk. When the amount sf hazardous materials being transported through the County is definitely determined, the full extent of the risk involved will be known. However, the

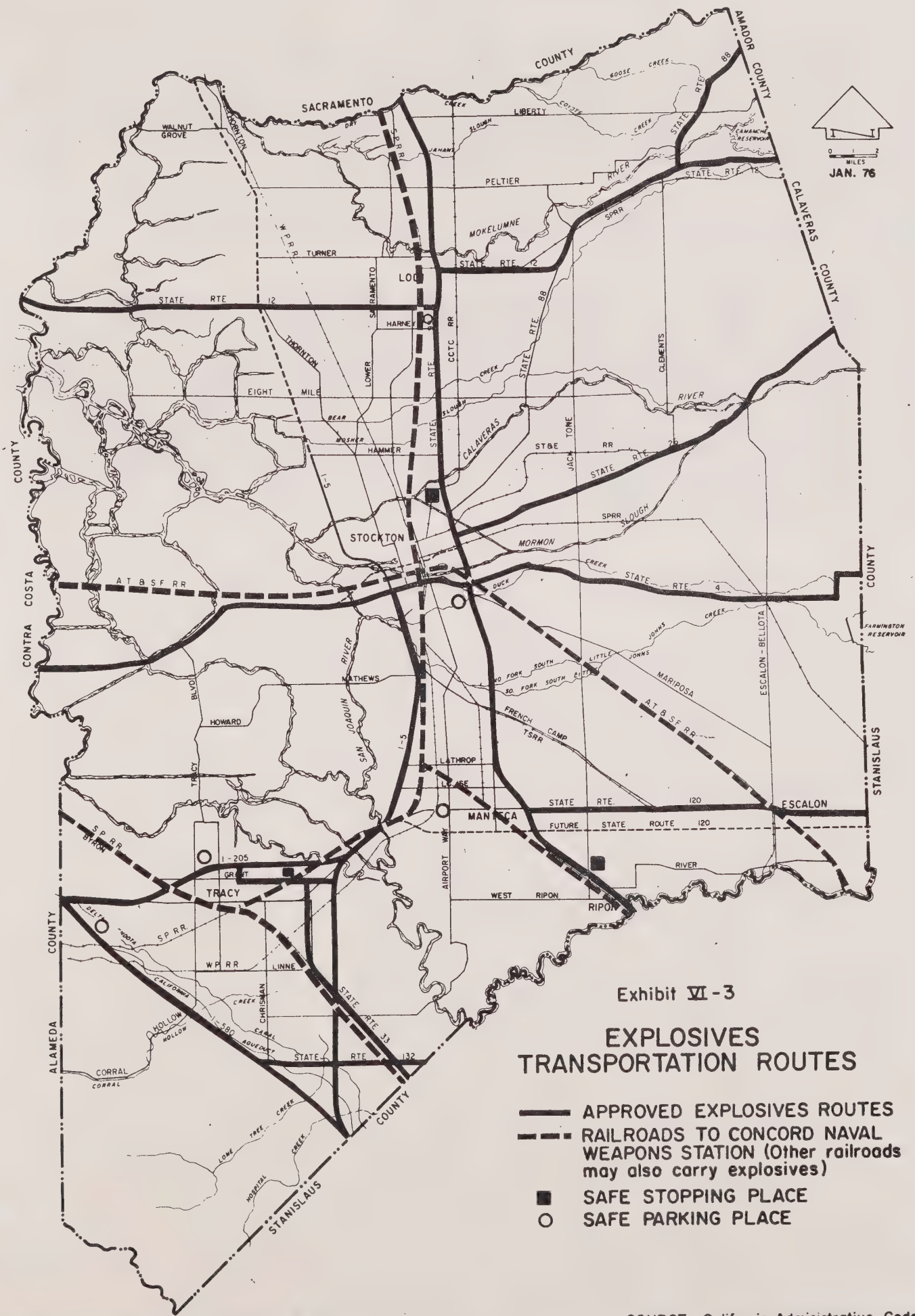

Exhibit VI-3

EXPLOSIVES TRANSPORTATION ROUTES

- APPROVED EXPLOSIVES ROUTES
- RAILROADS TO CONCORD NAVAL WEAPONS STATION (Other railroads may also carry explosives)
- ■ SAFE STOPPING PLACE
- ○ SAFE PARKING PLACE

SOURCE: California Administrative Code

SAN JOAQUIN COUNTY

chance of a disaster occurring because of the transportation of hazardous materials through the County is real and cannot be discounted. At the present time, the transportation of hazardous materials is regulated by various agencies. For example, liquified petroleum gas is regulated by the California Division of Industrial Safety. Flammable liquids are regulated by the State Fire Marshal. The California Highway Patrol regulates other hazardous materials.

PROBLEMS AND CONCERNS

Hazardous materials present several common problems with regard to their transportation, storage, and use. Much of the regulation of hazardous materials lies with the State and Federal governments. However, the County can exercise some land use control and be prepared for disasters. There needs to be awareness of the modes of transportation so that caution may be exercised in the location of residential areas and care facilities in relation to major routes. Storage areas need to be isolated from urban areas as well as from public facilities in rural areas. There is also the concern of a hazard spreading to other areas by virtue of air movement or explosions. (See Chapter IV: Fire Hazards)

CHAPTER VII

EMERGENCY PREPAREDNESS

PRINCIPLES

1. The County should continue its educational programs and support other programs which make people aware of possible hazards and preparedness measures.

2. The County should continue to initiate and coordinate emergency preparedness drills.

3. Paramedic services, particularly in the County's rural areas, should be supported.

4. The County should be prepared to implement the 911 system as soon as State subventions are made available.

5. The specific disaster relief responsibilities of public and semi-public agencies, County departments, and the private sector should be coordinated to eliminate overlapping responsibilities.

6. All persons responsible for implementation of the emergency plans should be periodically briefed on their responsibilities and participate in drills at the appropriate level.

7. The impact of all land use projects on the County's emergency relief system should be considered.

8. Project location, design and scope should be modified, if necessary, to balance emergency relief considerations with the primary function of the project.

9. Land use and design considerations, such as access, street widths and turnarounds, site and building design, and street naming and numbering systems should facilitate hazard prevention activities and emergency relief operations.

IMPLEMENTATION ACTIONS

1. The County Emergency Plan should be completed, and specific emergency plans prepared. (Office of Emergency Services and all departments responsible for preparing plan annexes)

2. Key emergency facilities should be evaluated as to their hazard susceptibility, and measures should be taken to reduce those hazards. (Office of Emergency Services, Building)

3. The County will continue to require a minimum 32 feet of paved roadway and 40 foot cul-de-sac radii in new developments to assure adequate room for movement of emergency equipment.

4. Private rights-of-way should provide more than 12 feet of roadway wherever possible.

5. County roads with less than a 32 foot paved width should be widened through improvement or acquisition of right-of-way as additional parcels are created or structures erected along the road.

INTRODUCTION

Prevention is the most economical, cost effective, and least stressful way to save lives and preserve property. Building on stable, flood-free soils; proper storage of hazardous materials; radar to detect speeding vehicles; fire marshal and prefire inspections; railroad crossing controls; bicycle lanes; patrol of swimming areas; airport clear zones; and safety education classes do save lives and preserve property; however, safety is also planning and preparing for emergency situations. The local community must anticipate possible needs and be able to respond to all emergencies to the fullest extent of its resources.

Identification, planning, coordination and preventive action are the key elements of emergency preparedness.

The local community must identify and recognize potentially hazardous situations that can not be prevented and determine what level of risk and emergency preparedness is acceptable. Local capabilities in the areas of facilities, equipment and trained manpower must also be identified before alternative courses of action can be plotted. All sectors of the community should be involved in planning how to best meet the objectives of emergency preparedness--the saving of lives, preservation of property, and, of equal importance, the continued functioning of the social and physical system in which we live. Local capabilities and resources must then be coordinated to achieve the most efficient and effective emergency response with the objective of handling and containing the situation, without causing additional problems.

Four broad levels of emergency planning and preparedness are identified for the purpose of discussion and organization in this portion of the Element: 1)short-term emergencies, 2)long-term emergencies, 3)disasters, and 4)decisions and actions of the government or private sector that can hamper or facilitate emergency response.

SHORT-TERM EMERGENCIES

Short-term emergencies happen with little or no warning and are generally confined to a single area, for instance, sudden acute injury or illness, a house fire, or auto accident. Some emergencies can be taken care of by those involved; however, most require the aid of trained professionals, such as repair persons, emergency medical technicians, paramedics, doctors, nurses, firemen and policemen, who are prepared to handle "short-term" emergency situations as part of their daily jobs, and to mobilize as part of a bigger organization in case of disaster.

Short-term emergencies differ from disasters and long-term emergencies basically in intensity and degree of mobilization; however, they all require private and public commitment of resources, expenditures and human risk.

A discussion of the County's emergency medical, ambulance and paramedic services follows a brief listing of those situations not often thought of as being short-term emergencies for which the Community must be prepared. Fire and police protection are discussed in Chapters IV and V.

In addition to those short-term emergencies like a house fire or auto accident, the community must be prepared to react and function when there are nondisaster emergencies such as power blackouts or brownouts, gas or water line breaks, sewer system failure, sudden need to dispose of large quantities of waste that might normally be otherwise processed or taken out of the County for disposal, source contamination of water supplies, inadequate sanitary facilities where there are crowds of people, road blockages, or prison breaks, to name a few.

All of these situations require the mobilization of human and physical resources, and are related to land use. Although it is everyone's responsibility to prepare for these kinds of emergencies to some degree, actual responsibility for program organization and subsequent action rests primarily with local government.

Emergency Medical Services

Seven hospitals in San Joaquin County offer emergency service, as shown on Exhibits VII-1 and VII-2.

Emergency medical services in the County are now being inventoried and evaluated by the North San Joaquin Valley Health Systems Agency and the County Emergency Medical Care Committee. The draft of the 1978 - 1983 Health Systems Plan (8) recommends that the County Committee, in addition to the progress already made, review and implement a series of action programs, including establishment of a County Emergency Medical Services management agency, centralized medical emergency dispatch services, district service areas for each hospital emergency department to avoid overlap and duplication of services, a management and medical information system, a process for the selection of primary emergency departments, County emergency review panels for providing system-wide patient care reviews, and improved communication and coordination between hospitals, County Emergency Medical Communities, emergency medical care personnel, County Health Departments, and public safety agencies both within the County and between member counties. The Plan also recommends that further expansion of emergency medical facilities in Modesto, Stockton and Merced medical markets be discouraged (8). The proposed systems approach to the provision of Emergency Medical Services in the north San Joaquin Valley (HSA-6) as set forth in the Plan "is designed to coordinate all existing and anticipated EMS resources in an efficient and effective manner to provide emergency services to everyone who needs such care in a timely and appropriate manner."[1]

The Plan identifies a number of goals, objectives and recommendations.

The Medical Services portion of the County Emergency Plan is being prepared (1). However, there is an existing system of emergency medical care in the County, and local hospitals have prepared plans for external and internal emergency situations.

In addition to the paramedic program, ambulances and hospitals are linked by the medical radio network discussed in the last section of this chapter.

Coroner disaster operations procedures are detailed in the Law Enforcement Section of the County Emergency Plan. Bodies are to be taken to local

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[1]North San Joaquin Valley Health Systems Agency. Health System Plan 1978-83 Draft. May, 1978, p. V-G-4.

mortuaries first, followed by use of the Commercial Building at the County Fair Grounds and then the County Crematory at the County Hospital.

Ambulance/Paramedic Service

Ambulance service is available to all areas of San Joaquin County served by roads. Sheriff Department patrol boats and Coast Guard boats, equipped with basic lifesaving and first aid supplies, respond to emergencies in those parts of the Delta not accessible by vehicle, transporting victims to a marina or dock if necessary.

In 1978, there were seven private and four nonprofit ambulance companies operating 29 ambulance vehicles in the nine San Joaquin County ambulance zones (Exhibit VII-3)(6). The average response time within these zones, from the receipt of an emergency request to the arrival of the ambulance is 5.1 minutes in urban areas and 9.4 minutes in rural areas (2), which is within State minimum standards.

Ambulance attendants determine to which facilitiy a patient-wwll be taken; however, patient preference is observed in most cases. For those emergency cases in which the patient does not express a preference, or in which the attendant feels the specified hospital is inappropriate, state law requires that the patient be taken to the closest facility with emergency capabilities.

State law also requires that all ambulance attendants have minimum training as an EMT-1 (Emergency Medical Technicial-1). EMT-1's must be prepared to appraise the condition of the victim, assess the effectiveness of whatever care was provided prior to their arrival, and then continue to maintain the victim by means of life support measures until care is assumed by licensed health professionals.

Paramedics are certified life support personnel, trained and authorized to inject drugs and intravenous fluids, heart defibrillation and electrocardiogram monitoring, in addition to basic and specialized emergency medical skills. At this time, the paramedic program in San Joaquin County is basically an urban service in Stockton and Lodi areas (Exhibit VII-3). However, it could be very beneficial in the rural areas. The State Plan for Emergency Medical Services states, "morbidity and mortality rates resulting from sudden acute illness and accidential injury, particularly in rural or isolated areas where transportation time is likely to be lengthy, can be significantly reduced by the ability of emergency medical technicians to competently perform only a few special procedures beyond those included in EMT-1 level training."[1]

Three full-time paramedic units serve the City of Stockton and the area within the Lincoln Rural Fire Protection District. Lodi Ambulance, a private company serving northern San Joaquin County, has three paramedics and a mobile intensive care nurse (Exhibit VII-3). The Stockton program is currently part of the City Fire Department, which also provides 24-hour central dispatch services for the three Stockton ambulance zones. San Joaquin County Hospital is the primary base station for paramedic calls and St. Joseph's and Dameron in Stockton are secondary stations. These hospitals each have a trained physician and Mobile Intensive Care nurse on duty around-the-clock. Memorial and Community Hospitals in Lodi are victim-receiving hospitals, and do not communicate instructions to the paramedics in the field. There are no immediate plans to expand the program in the County (5)(6).

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[1] California State Plan for Emergency Medical Services (2).

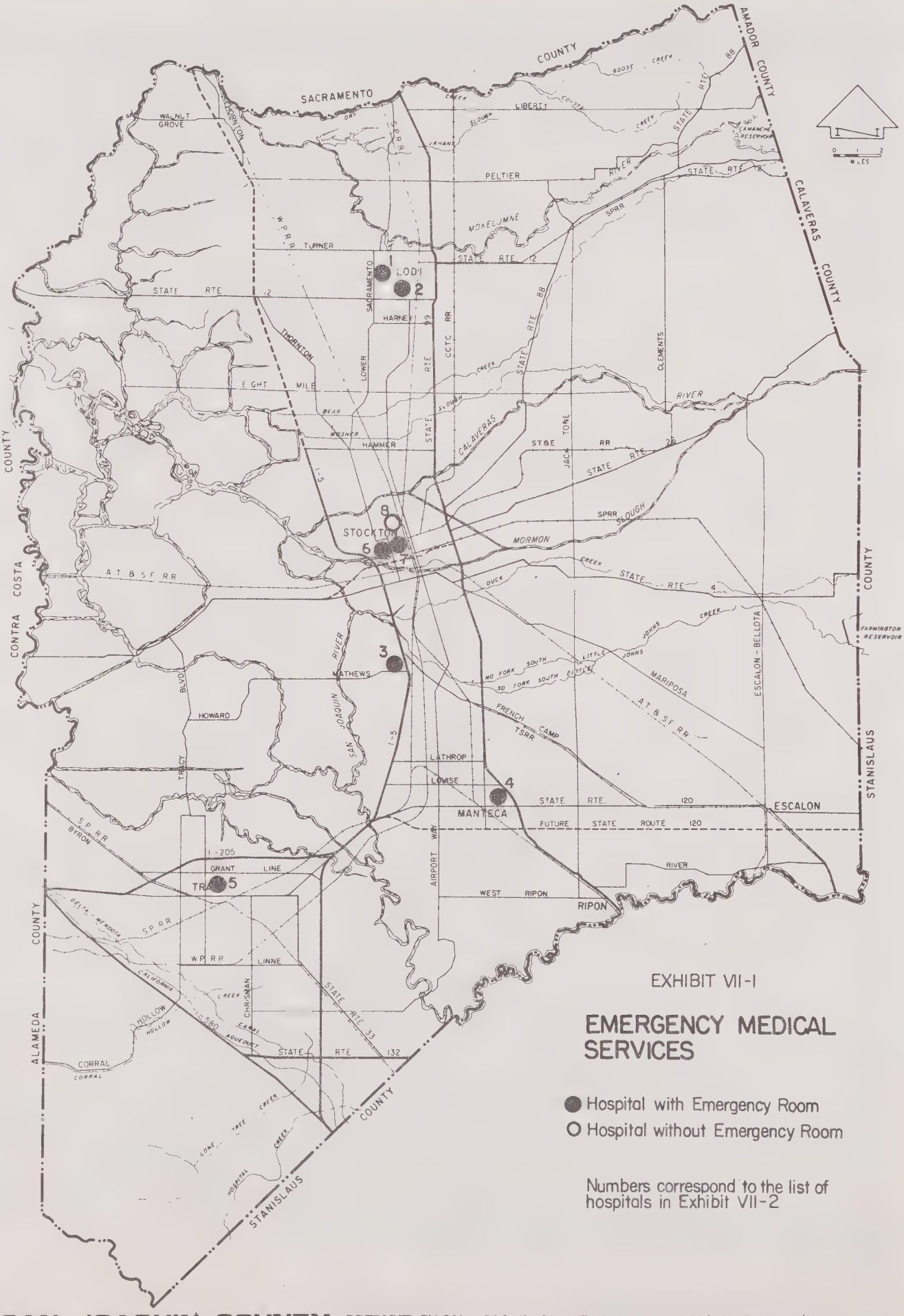

EXHIBIT VII-1

EMERGENCY MEDICAL SERVICES

● Hospital with Emergency Room

○ Hospital without Emergency Room

Numbers correspond to the list of hospitals in Exhibit VII-2

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Exhibit VII-2

EMERGENCY MEDICAL SERVICES

INVENTORY OF EMERGENCY MEDICAL SERVICES AND SELECTED SERVICES				Type of Service		Physician Staffing				Facilities & Services				Emergency Communication Capabilities								
NAME OF FACILITY	CITY	TYPE OF OWNERSHIP	ACUTE BED CAPACITY	EMERGENCY SERVICE OFFERED	SEPARATE ROOM PROVIDED	PHYSICIAN STAFFING	IN-HOUSE 24 HOUR	ON CALL 24 HOUR	ANESTH. IN 24 HOUR OR ON CALL	PSYCHIATRIC EMERGENCY	INTENSIVE CARE UNIT	CARDIAC CARE UNIT	BLOOD BANK	2 WAY RADIO WITH OTHER HOSP.	2 WAY RADIO WITH CHIEF OF E.R.	2 WAY RADIO WITH PHYSICIAN	2 WAY RADIO WITH AMBULANCE	2 WAY RADIO WITH AMBULANCE COMP. BASE	2 WAY RADIO WITH CENTRAL DISPATCH	2 WAY RADIO WITH LAW ENFORCE.	2 WAY RADIO WITH FIRE DEPT.	ADVANCE RADIO COMMUNICATION REGARDING PRIOR CARE GIVEN
(1)* Lodi Community Hosp.	Lodi	PROP	93	Y	Y	1	Y		Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
(2) Lodi Memorial Hosp.	Lodi	NPA	99	Y	Y	1	Y		Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	N	N	Y
(3) San Joaquin General Hospital	French Camp	CO	260	Y	Y	1	Y		Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	Y
(4) Manteca Hospital	Manteca	PROP	49	Y	Y	1	N	Y	Y	Y	N	Y	N	Y	Na	Na	Y	Na	Na	Na	Na	N
(5) Tracy Community Hospital	Tracy	NPA	59	Y	Y	1	N	Y	Y	Y	Y	Y	N	Y	N	N	Y	Y	Y	Y	N	Y
(6) Dameron Hospital	Stockton	NPA	148	Y	Y	1	Y		Y	Y	Y	Y	N	Nr	Nr	Nr	Nr	Nr	Nr	Nr	N	Y
(7) St. Joseph's Hosp.	Stockton	NPA	300	Y	Y	1	Y		Y	Y	Y	Y	Y	N	N	N	N	N	N	N	N	N
(8) Oak Park Community Hospital	Stockton	PROP	43	N																		

KEY: Physician Staffing
1 - Full-time emergency staff physicians
* - Refers to map location

PROP - Proprietary
CO - County
NPA - Non-Profit Association

Y - Yes
N - No
NR - Non Reported
NA - Not Available

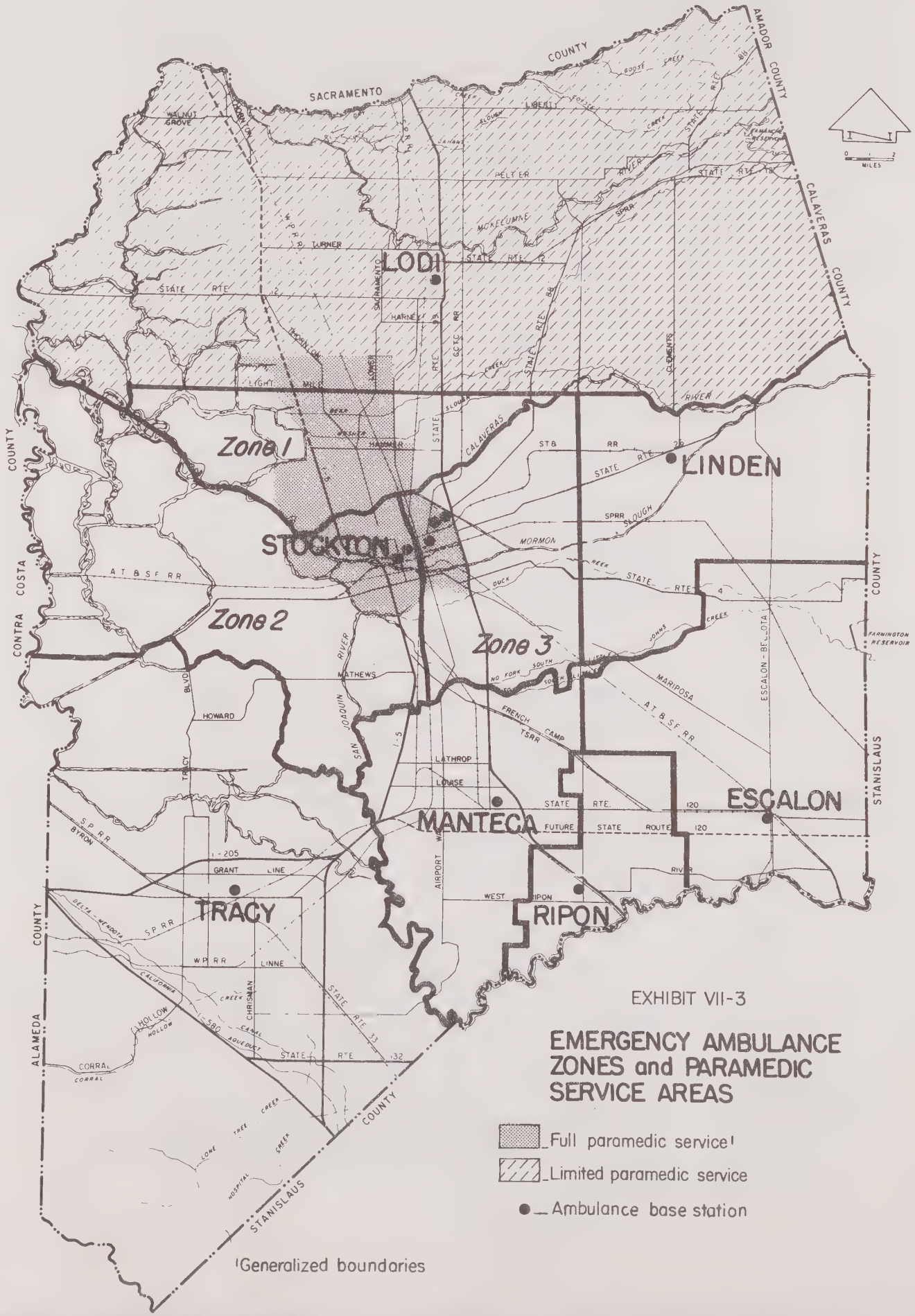

EXHIBIT VII-3

EMERGENCY AMBULANCE ZONES and PARAMEDIC SERVICE AREAS

- Full paramedic service[1]
- Limited paramedic service
- Ambulance base station

[1]Generalized boundaries

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During a declared local or regional disaster, ambulance and paramedic squads will function according to the County Emergency Plan, presumably under the direction of the Office of Emergency Services.

LONG-TERM EMERGENCIES

Long-term emergencies are not everyday occurrances, and generally happen over a period of time. However, they often spawn short-term types of emergencies and like many short-term emergencies, have the potential for becoming disasters. These kinds of emergencies include drought, heat-waves, epidemics, pestilence, long periods of fog, labor strikes, gasoline and energy shortages, cold snaps, economic depression, transportation shut-downs, and animal diseases which are important to San Joaquin County.

Long-term emergencies generally affect a large region; therefore, governmental action is necessary to coordinate relief efforts. In addition to the role of coordinator and response agent, the local government must be programmed to recognize these kinds of emergencies in time to develop specific actions to mitigate the problem and possibly avert disaster.

DISASTER PLANNING

Disaster planning and relief involves not only emergency professionals but other sectors of the community as well, depending upon the disaster.

The key to effective disaster preparedness and action is a workable plan, practice, and more planning, which especially involves those people who will probably be the first to respond.

A very important aspect of disaster preparedness is training personnel to evaluate emergency situations and recognize those which are potential or real disasters so the emergency organization set up in the Emergency Plan can be mobilized as early as possible when it can be most effective.

Specific Emergency Plans

The County Emergency Plan is programmed for activation during any one or more of nine broad kinds of emergency situations, i.e., flood, fire, accident, etc. The County Plan is described at the end of this section. A Dam Failure Plan was prepared in 1977 by the Office of Emergency Services, which is now preparing other specific plans.

The principal objectives of the Dam Failure Plan (9) are to provide framework for orderly alert and evacuation, and subsequent security of flood areas. The Plan also defines general organizational responsibilities, and specific responsibilities and facts for each of the dams whose failure would cause flooding in San Joaquin County.

The maps for each dam delineate probable areas of inundation, flood wave arrival times, and evacuation routes. Threatened key facilities and unique institutions are also listed. Mass care facilities, staging areas, emergency operating centers, and airports have been identified in the Dam Failure Plan; however, these facilities can be used as needed in case of any disaster. All of the schools in the County, community centers, lodges and clubhouses, and in some cases churches, are mass care centers. If necessary, tents can be erected in predesignated areas, in addition to the use of motels and private

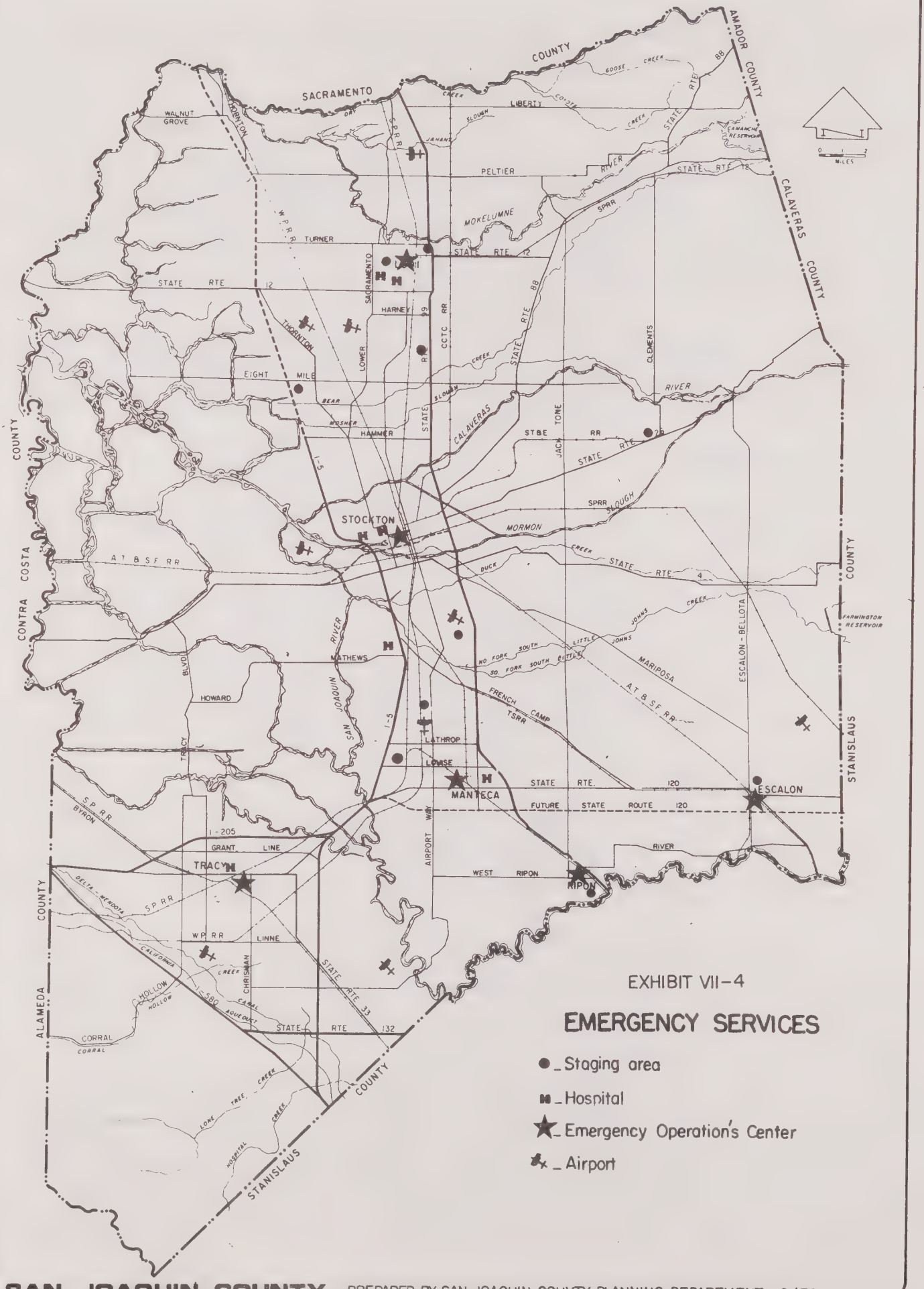

EXHIBIT VII-4

EMERGENCY SERVICES

- ● _ Staging area
- H _ Hospital
- ★ _ Emergency Operation's Center
- ✈ _ Airport

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homes. When the disaster is of a magnitude that out-of-County assistance is required, a system of radio alert and activation of internal emergency plans has been established under the provisions of the State Master Mutual Aid Agreement (9). All but mass care facilities are shown on Exhibit VII-4.

Multiple disasters are a possibility in San Joaquin County. For instance, an earthquake could cause complete failure of utilities, communication systems and transportation networks throughout the County, at the same time causing a dam failure resulting in the threat of inundation. Levee breaks due to liquefaction in the Delta could compound the problem with inundation of additional area that would have otherwise been flood-free. The problems are obvious--where do people go, how do they get there and what are the priorities for relief efforts.

Disaster preparedness and response is definitely related to land use and other aspects of community planning. Nearly all physical systems must become an asset to the relief effort, and if not properly planned prior to a disaster, they could become a liability or even a hazard, as discussed in the last section of this chapter.

The County Emergency Plan

The Emergency Plan is a comprehensive disaster preparedness program, concerned not only with a war threat, but primarily with the threat of disaster as a result of natural and/or man-made hazards and factors. The County Emergency Plan (1) states, "The County of San Joaquin will respond to the following types of emergency situations:

- earthquake
- tsunami - mutual aid response only[1]
- flood
- fire
- accident (transportation, industrial, radiological incident)
- civil disturbance (riot)
- storm
- pollution
- epidemic[2]

Proper planning and utilization of an emergency plan reduces reaction times and improves coordination, thereby saving lives and preserving property. The existence and maintenance of operable local emergency plans make it possible to use existing resources and capabilities at greater levels of efficiency and effectiveness. The proper development and implementation of a local plan also prompts identification of potentially disastrous situations, and subsequent development of measures aimed at weakening the impact or alleviating the hazard.

The 1975-77 San Joaquin County Emergency Plan was prepared by the County Office of Emergency Services and adopted by the Board of Supervisors in 1975. State law requires that the plan be revised biannually.

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[1]Tidal waves are not a hazard in the County.
[2]San Joaquin County Emergency Plan, p.2

The Plan states, "Civil government, augmented and reinforced during an emergency, conducts emergency operations, provides or utilizes mutual aid, and controls critical and essential resources. Civil government also provides support to military forces engaged in retaliatory or defensive operations.[1]

The purpose of the basic Emergency Plan and the more detailed divisional plans, called annexes, is to:

"1. Provide a basis for the conduct and coordination of emergency operations and the effective management of critical resources during emergencies.
2. Establish a mutual understanding of the authority, responsibilities, functions and operations of civil government during emergencies.
3. Provide a basis for incorporating into the County emergency organization non-governmental agencies and organizations having resources necessary to meet foreseeable emergency requirements."[2]

The Plan "identifies foreseeable organizational requirements, tasks, resource requirements, and basic procedures for the conduct of emergency operations. Non-essential governmental and private activities may be reduced or stopped, depending upon emergency conditions."[3]

The Plan was adopted with the following Assumptions and Objectives:

"1. The responsibility for emergency preparedness rests with civil government at all levels.
2. Adequate pre-emergency testing of facilities and equipment will ensure reliable functioning.
3. Available warning time, used effectively, will decrease potential life and property loss.
4. The nature and extent of an emergency will govern which elements of the emergency organization will mobilize and respond."[4]

The County of San Joaquin Emergency Organization (See Exhibit VII-5) will plan, prepare for and conduct emergency operations in order to accomplish the following objectives:

" 1. Save lives and property
2. Repair and restore essential systems and services
3. Provide for the protection, use and distribution of remaining resources
4. Provide a basis for direction and control of emergency operations
5. Provide for the continuity of government
6. Coordinate operations with the emergency service organizations of other jurisdictions."[5]

The Emergency Plan goes into effect:

"1. Automatically by the existence of a State of war emergency
2. When the Governor has proclaimed a state of emergency

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[1]Ibid, p.3
[2]Ibid, p.1
[3]Ibid, p.3
[4]Ibid, p.5
[5]Ibid, p.5

3. On the order of the Chairman of the Board of Supervisors, acting as Director of Emergency Services, provided the existence of a local emergency has been proclaimed in accordance with the provisions of the Emergency Services Ordinance of the County."[1]

"In addition, the Director of Emergency Services is authorized to order the mobilization of the County emergency organization or any portion of the organization in order to provide for increased readiness in the event of the threatened existence of an emergency prior to the full implementation of the Plan."

The San Joaquin County Emergency Services Council has the responsibility of developing and recommending for adoption by the Board of Supervisors, "emergency and mutual aid plans and agreements and such ordinances and resolutions and rules and regulations as are necessary to implement and fulfill the purpose of the Emergency Plan."[2]

The Council was set up by County ordinance in 1971 and is composed of the chairman of the Board of Supervisors (Director of Emergency Services); County Administrative Officer, County Emergency Services Officer; all chiefs and officers of the staff Sections, Emergency Services Units and Emergency Resource Management Division, and any representatives of municipalities, civic, professional and industrial organizations as may be appointed by the Board of Supervisors.

The primary responsibility of the Director of Emergency Services is to control and direct the efforts of the Emergency Organization (Exhibit VII-5) which is composed primarily of County Departments organized into functional divisions. Each Division of the organization (or County Department) is required to prepare an operational plan which is included with the basic Emergency Plan as an annex. The annexes are being prepared, as are specific plans for dam breaks, floods and earthquake.

DECISIONS AND ACTIONS AFFECTING EMERGENCY PREPAREDNESS

The final level of emergency preparedness is the responsibility of those who make decisions and take actions on programs or projects that can have a very important and relatively unrecognized effect on emergency preparedness and response.

Design considerations such as driveway widths, building overhangs, road widths and turnarounds, parking facilities, door and window locations and site design, to name a few, can hamper or facilitate the movement and use of equipment and emergency response efforts. Pavement width and signing deserve special mention, since they are problems in the County.

Presently, the County standards for new roads require a minimum paved width of 32 feet and a 40 foot radius on a cul-de-sac. These standards are adequate for the movement of most fire apparatus if the roadways are not blocked. However, they generally serve a limited number of structures. Twelve (12) feet is accepted in most rural areas as adequate width for one-way traffic movement where there are very low traffic volumes. There are very few locations on most rural roads for large trucks to turn around.

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[1]Ibid, p.2
[2]Ibid, p.8

The time needed to respond to an emergency is increased when the location of the emergency can't be found. Structures are often difficult to locate in rural areas, but urban areas can also be problems without proper signing. Street addresses and street signs should be placed so that they are easily seen from the roadway. In addition, duplicate road names, or names which could be confused, should be avoided.

Land use and location are also very important factors. For example, residences are not appropriate adjoining an industry processing hazardous products, while at the same time houses may not be appropriate in rural areas either, if the emergency response system is nonexistent, inadequate, or the conflict between residential uses and agricultural uses is a potential hazard. Industries and commercial uses are best located where they can take advantage of existing emergency systems or where they can be assured of future services. The location of specific land uses is also important, for instance the cannery must consider disposal of waste products if the existing system fails; and hospitals, ambulance barns, fire stations, and police facilities must be located where they can provide maximum coverage. Location of docks and marinas, telephones, and even parking spots are a few of the other kinds of land use considerations that can have an affect on response times.

The physical system of the County must become an asset, and not a liability in the event of any kind of emergency. In conflicting cases, decision makers must be prepared to make priority decisions based on policies.

There is a cost to the public and a high risk of human life each time there is an emergency; however, these costs and risks can be alleviated if projects or activities are not approved in known or potentially hazardous areas.

Decisions on the establishment or consolidation of special districts, tax zones, utilities districts, and service areas also affect the provision of emergency services. Even agricultural crops and their location can be related to the emergency system.

Communication systems have become vital to daily life and certainly are a major component of the emergency system. The 911 telephone system and radio communications in San Joaquin County are discussed below.

The above are all considerations not only in preventing, speeding or slowing emergency response, but also in terms of the entire emergency preparedness organization. It is very important that as many components as possible of the normal operating system of daily life in the County continue during an emergency to provide support for that portion of the system affected by the emergency and to help ensure that the system will function as normally as possible for the security of both those who are directly involved and those not involved at all.

Radio Communication

On a daily basis and in time of disaster, radio communication systems are one of the most important aspects of emergency preparedness. The four emergency-related networks in use in San Joaquin County at the present time are summarized in Exhibit VII-5. A framework for integrated use and operation of these networks during a disaster is being developed by the Office of Emergency Services.

Exhibit VII-5

SAN JOAQUIN COUNTY RADIO COMMUNICATION NETWORKS

Emergency Medical Network	Fire Network	Law Network	Local Gov't Network
VHF 11 Ambulance Companies (inc. portable short-range radios used in the field) 7 Hospital emergency rooms Stockton Police Department Stockton Fire Department	VHF 22 Fire districts 4 City Fire Dept. Airport crash and rescue County Fire Warden Sheriff Office Emergency Services	VHF Sheriff City Police Depts. (except Stockton) County Jails Honor Farm CHP OES	UHF Public Works Department Parks & Recreation Animal Control Agriculture Department Weights/Measures Building Inspection Motor Pool Sheriff Board of Supervisors Office of Emergency Services
St. Joseph's & County hospitals have radio link with regional hospitals			
regularly used by ambulance companies to communicate with hospitals	limited daily use	limited daily use	limited daily use

911 Telephone System

911 is a single three-digit emergency telephone number to be used Statewide. The system is intended to shorten the time between the detection of an event and the dispatch of assistance. When fully implemented, more than 60 seven-digit numbers will be replaced in San Joaquin County.

911 emergency calls will go to trained Public Safety Answering Point operators, who will either dispatch help directly or relay the call to the appropriate public safety agency. There will be 911 emergency answering points in Stockton, Lodi, Tracy and Manteca, located in the City Police Departments. Tracy has successfully established their 911 system and the three remaining cities will comply with future State Guidelines.

State law requires the establishment of uniform emergency telephone services for at least emergency public safety service agencies by December 31, 1985. Final plans are requested by October 1, 1978. The 911 system will be principally funded from state subventions, derived from a ½% surcharge now being collected on phone service. San Joaquin County now has 100% signed agreement from involved public safety agencies to its tentative 911 plan.

The 911 system will be beneficial to people in San Joaquin County because of the large number of special districts and jurisdictions whose service boundaries are seldom known by those who might be calling in an emergency, particularly if it is on a highway.

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